

The bones of the lower limb form pelvic girdle & 3 segments. The girdle is complete as the 2 hip bones articulate together anteriorly (at symphysis pubis) and posteriorly with the sacrum.

The 3 segments are:

- First segment: Femur (the skeleton of the thigh).
- Second segment: Tibia and fibula (bones of leg).
- Third segment: Bones of the foot.

## The Hip Bone

The hip consists of three bones articulating by Y-shaped articulation at the acetabulum.

These bones are (Fig.2):

- **Ilium:** The upper 2/5 of the hip bone.
- **Ischium:** The lower posterior 2/5 of the hip. It is formed of body, tuberosity and a ramus.
- **Pubis:** The lower anterior 1/5 of the hip. It is formed of superior, inferior rami and body.

### The hip bone has 4 borders:

1. **Upper border (iliac crest)** is formed of:

- Anterior 2/3:
- It is thick, convex outwards with outer, inner lips & intermediate rough part.
- Has iliac tubercle 5 cm from the anterior superior iliac spine.
- Posterior 1/3: - Is thin and concave outwards.

N.B.: The highest point of the iliac crest (a little behind its midpoint) is in level of L3/ L4 vertebrae.

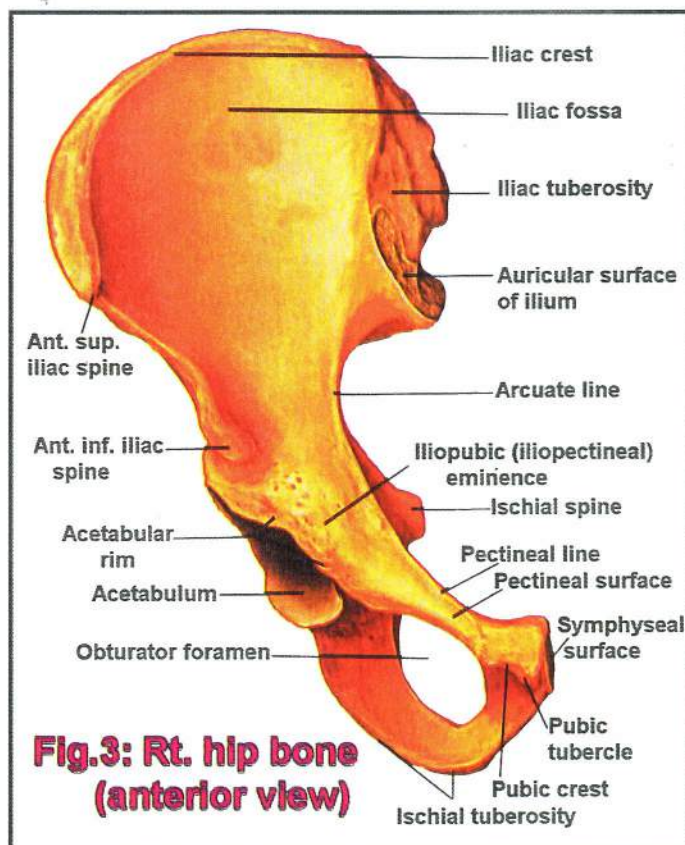
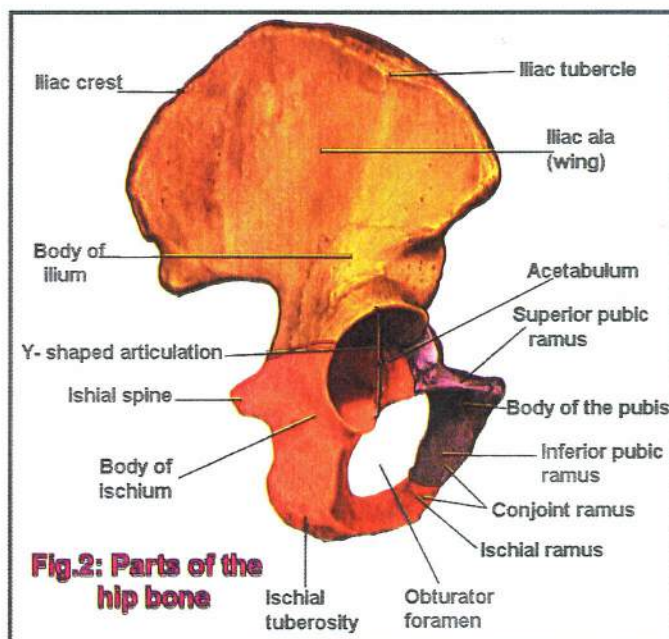
2- **Lower border:** Is formed of the inferior pubic ramus and ischial ramus (conjoint rami).

3- **Anterior border:** Has the following features from above downwards (Fig.3):

1. Anterior superior iliac spine (A.S.I.S.).
2. Anterior inferior iliac spine.
3. Iliopubic (iliopectineal) eminence.
4. Pectineal border & surface of superior pubic ramus.
5. Pubic crest, tubercle.

4. **Posterior border:** From above downwards, it presents the following features:

1. Posterior superior iliac spine.
2. Posterior inferior iliac spine.





3. Greater sciatic notch. 4. Ischial spine. 5. Lesser sciatic notch.

### 6. Ischial tuberosity:

It is divided by a transverse ridge into upper quadrangular and lower triangular parts.

The upper quadrangular part is divided by an oblique ridge into upper lateral and lower medial areas.

The lower triangular part is divided by a longitudinal ridge into lateral and medial areas.

### The hip bone has 2 surfaces

(Figs 4 & 5):

**1- Outer surface:** Has the following features.

**A. Three gluteal lines:** Posterior, middle (anterior) and inferior.

**B. Acetabulum:** Is the socket of the hip joint, it has:

- Horse - shoe articular surface (lunate surface).
- Rough non articular (acetabular fossa) in the concavity of lunate surface.
- Acetabular notch: A deficiency on the inferior aspect of the acetabulum.

### **C. Obturator foramen:**

It lies below and slightly anterior to the acetabulum.

The obturator membrane fills this foramen except superiorly (obturator canal).

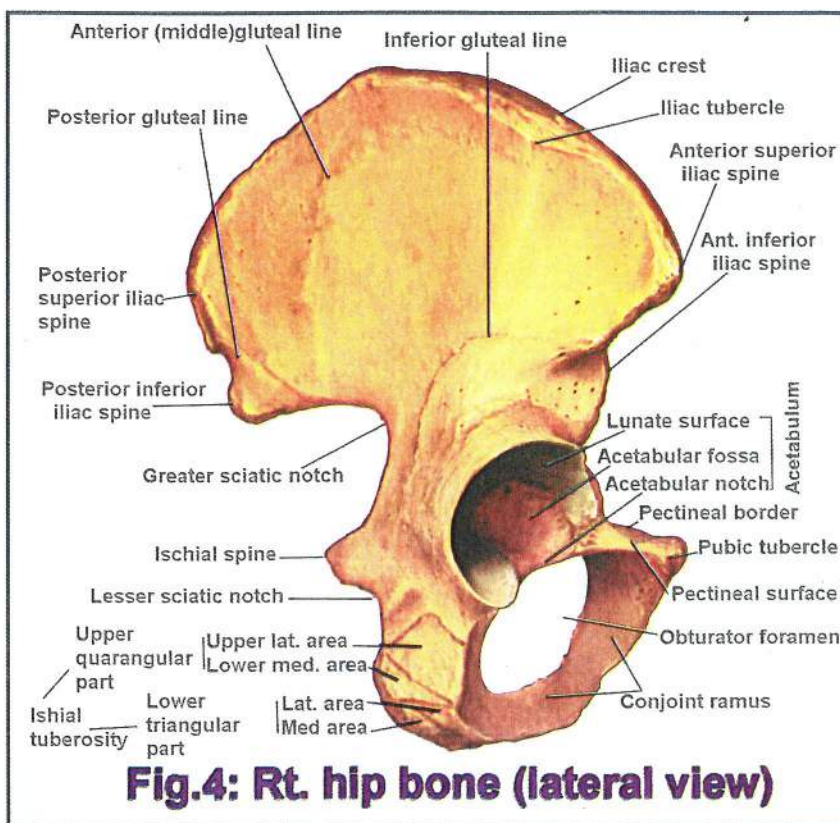
The obturator canal allows passage of obturator nerve & vessels.

**2- Inner surface:** Contains the following features:

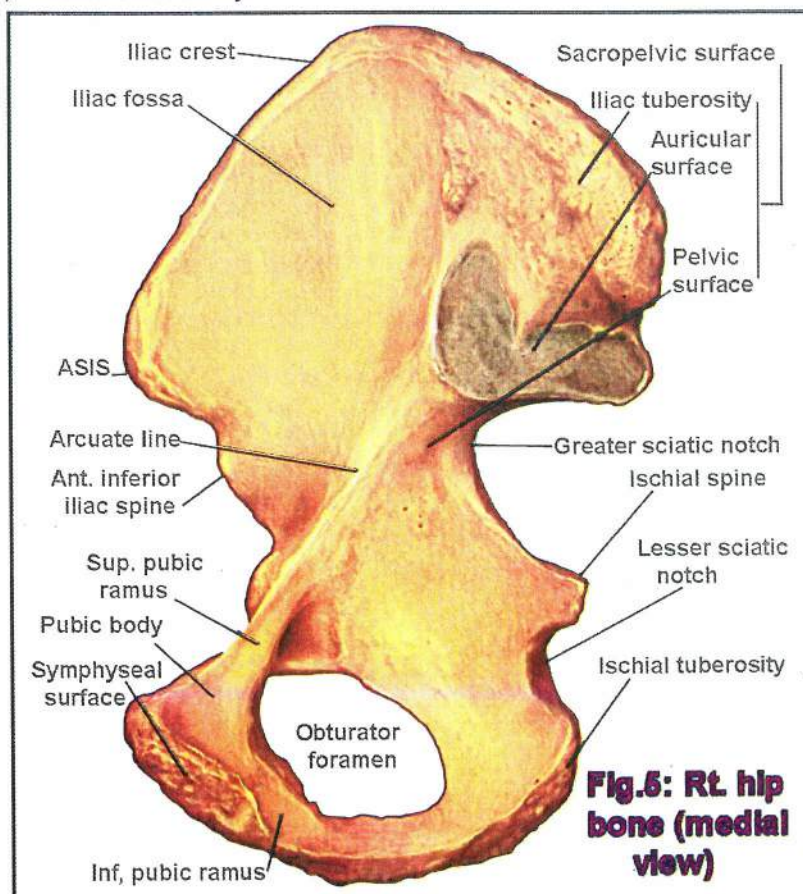
**A. Iliac fossa:** Is the internal concavity of the ilium.

**B. Sacropelvic surface:** Shows:

- Rough iliac tuberosity.
- Auricular surface for articulation with the sacrum.
- Pelvic surface of the hip bone.



**Fig.4: Rt. hip bone (lateral view)**



**Fig.5: Rt. hip bone (medial view)**



**C. Arcuate line:** Separates the sacropelvic surface from the iliac fossa.

The pubis has the following parts and features:

1. **Body:** Has: - 3 surfaces: Anterior, posterior and medial symphyseal surfaces.  
- Upper border (*pubic crest*), its lateral extremity is the *pubic tubercle*.
2. **Superior ramus:** Has 3 surfaces:
  - A. Pectineal surface, bounded behind by the pectineal line (*pecten pubis*).
  - B. Pelvic surface.
  - C. Obturator surface.
3. **Inferior ramus:** Has internal and external surfaces.

### How to determine the side:

We put the hip bone in anatomical position with:

- Iliac crest (above). - Ischial tuberosity (below & behind). - Acetabulum (lateral).

**NB:** The position of the hip bone in the erect posture may be demonstrated by holding it so that the anterior superior iliac spine and the top of pubic symphysis are in the same vertical plane.

**NB:** In the sitting posture, the body rests on the medial and lower parts of the ischial tuberosities.

### Subcutaneous parts of hip bone:

1. Anterior superior iliac spine.
2. The whole of iliac crest.
3. Ischial tuberosity.
4. Pubic tubercle, to feel it abduct, flex and laterally rotate the thigh. The rounded tendon of adductor longus is felt. The bony prominence just above it is the pubic tubercle.

### Ossification of hip bone:

- The junction between pubic and ischial rami ossifies at 8 years.
- The tri-radiate cartilage of the acetabulum ossifies at 15 years.
- Both ischial tuberosity and ossification centres of iliac crest fuse at 25 years.

### Nerves related to the hip bone:

- **The sciatic nerve** lies at the inferior margin of the greater sciatic notch.
- **The obturator nerve** runs in the obturator groove.
- **The pudendal nerve** runs in the pudendal canal along the inner surface of ischial tuberosity.

### Sex differences of the hip bone:

Differences	Male	Female
1. Subpubic angle.	Acute (50-60 degrees).	80-85 degrees.
2. Edge of pubic arch.	More everted.	Less everted.
3. Distance from symphysis pubis to anterior margin of acetabulum	Equals transverse diameter of acetabulum.	More than transverse diameter of acetabulum
4. Greater sciatic notch.	Deep and narrow.	Wide and shallow.
5. Obturator foramen.	Oval.	Triangular
6. Iliac fossa.	Shallow.	More concave.
7. Auricular surface.	Articulates with 2 1/2 sacral pieces.	Articulates with 2 sacral pieces.

## Particular features of the hip bone

### A. Muscles attached

Site	Muscle attached	O or I	Exact site of attachment
Iliac crest	Tensor fascia lata	Origin	Outer lip of iliac crest bet. ASIS & iliac tubercle.
	Latissimus dorsi	Origin	Outer lip of iliac crest behind the highest point.
	Gluteus maximus	Origin	Outer surface of the posterior part.
Anterior border	Sartorius	Origin	Lower part of the ASIS.
	Straight head of rectus femoris	Origin	Upper part of the anterior inferior iliac spine.
Outer surface of the body of the pubis & conjoint ramus	Gracilis	Origin	Body of pubis & inferior pubic ramus.
	Adductor longus	Origin	Outer surface of the body of the pubis.
	Adductor brevis	Origin	Outer surface of body of pubis & inferior pubic ramus.
	Adductor magnus (pubic part)	Origin	Outer surface of conjoint ramus.
	Obturator externus	Origin	Outer margin of obturator foramen.
	Pectineus	Origin	Pectineal surface & line of the superior pubic ramus.
Ischial tuberosity	Semimembranosus	Origin	Upper lateral area of the upper quadrangular part.
	Semitendinosus & long head of biceps	Origin	Lower medial area of the upper quadrangular part.
	Adductor magnus (ischial part)	Origin	Medial area of the lower triangular part.
	Quadratus femoris	Origin	Lateral border.
Lesser sciatic notch	Gemellus superior	Origin	Upper margin of the lesser sciatic notch.
	Gemellus inferior	Origin	Lower margin of the lesser sciatic notch.
Gluteal surface of the ilium	Gluteus maximus	Origin	Gluteal surface of ilium behind the posterior gluteal line.
	Gluteus medius	Origin	Gluteal surface of ilium between the posterior & middle gluteal lines.
	Gluteus minimus	Origin	Gluteal surface of ilium between the middle & inferior gluteal lines.
	Reflected head of rectus femoris	Origin	Area above the acetabulum.
Inner surface of hip bone	Iliacus	Origin	Floor of the iliac fossa.
	Obturator internus	Origin	Inner margin of the obturator foramen & pelvic surface of ilium till the greater sciatic notch.
	Levator ani	Origin	Body of pubis & ischial spine.
	Psoas minor	Insertion	Iliopubic eminence.



**B. Ligaments attached**

Ligament		Hip attachment
Inguinal ligament	Main part	Extends between ASIS & pubic tubercle.
	Lacunar lig.	Medial part of the pectineal line.
	Pectineal lig.	Whole length of the pectineal line.
Sacrotuberous ligament	Upper end	Posterior superior, inferior iliac spines & sacrum.
	Lower end	Ischial tuberosity (medial margin).
Sacrospinous ligament		Ischial spine.
Iliolumbar ligament		Inner lip of the iliac crest (at the highest point).
Iliofemoral ligament		Connects AIIS to the intertrochanteric line.
Superior & inferior pubic ligaments		Upper & lower aspects of the symphysis pubis.
Ligaments of the acetabulum	Labrum acetabulare	To the margins.
	Transverse acetabular lig.	On acetabular notch.
	Round lig. of the femur	To transverse acetabular ligament.
Ligaments of sacroiliac joint	Posterior sacroiliac lig.	To posterior part of the iliac tuberosity.
	Interosseous sacroiliac lig.	To the iliac tuberosity.
	Anterior sacroiliac lig.	To the preauricular sulcus.

N.B: The following areas give attachment to a muscle and a ligament:

1. Anterior superior iliac spine: A. Upper part: Inguinal ligament. B. Lower part: Sartorius muscle.
2. Anterior inferior iliac spine: A. Upper part: Straight head of rectus femoris.  
B: Lower part: Iliofemoral ligament.
3. Pubic tubercle: A. Cremasteric muscle. B. Inguinal ligament.
4. Ischial spine: A. Coccygeus and levator ani muscles. B: Sacrospinous ligament.

## The Femur (the thigh bone) (Figs. 6 & 7)

It is the strongest and longest bone in the body.

It is long bone with a shaft and two ends.

### A- Upper end shows:

#### 1- Head:

- Is directed upwards, forwards and medially.
- It shows the fovea which gives attachment to the ligamentum teres (round ligament of femur).

#### 2. Neck: (5 cm long).

- Forms "neck shaft angle" with the shaft, (about 125°) which facilitates hip movements.
- The neck is laterally rotated about 10-15° (angle of torsion or anteversion).

NB: Angle of inclination is the angle between long axis of the femur & tibia (is about 170°).

#### 3. Greater trochanter:

- Is a quadrangular eminence which lies laterally at the junction of the neck with the shaft.



- Its medial surface presents depressed area called trochanteric fossa.

**4. Lesser trochanter:** Lies posteromedially.

**5. Intertrochanteric line:** A roughened ridge connecting the greater & lesser trochanters anteriorly.

**6. Intertrochanteric crest:** A smooth rounded ridge connecting the greater & lesser trochanters posteriorly. Above its middle it presents the quadrate tubercle.

### B- Shaft

The shaft is cylindrical, but its middle third is nearly prismatic with 3 borders & 3 surfaces.

**1. Posterior border (linea aspera):** Crest like projection with lateral and medial lips.

**2. Medial border:** Rounded and ill defined.

**3. Lateral border:** Rounded and ill defined.

**4. Anterior surface:** Lies between the medial & lateral borders. It is smooth & convex.

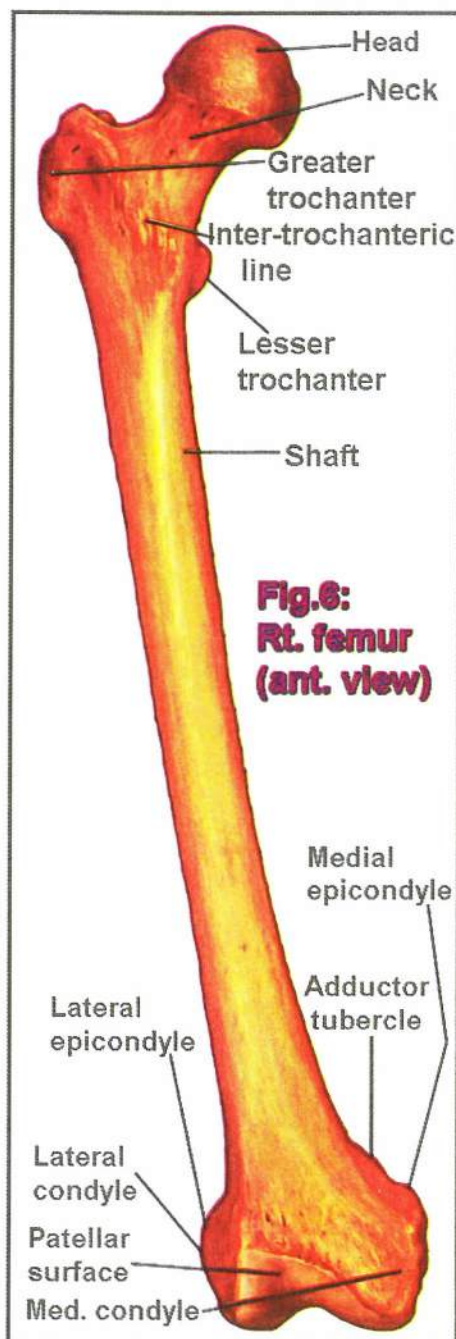
**5. Medial surface:** Lies between the medial & posterior borders. It faces backwards & medially.

**6. Lateral surface:** Lies between the lateral & posterior borders. It faces backwards & laterally.

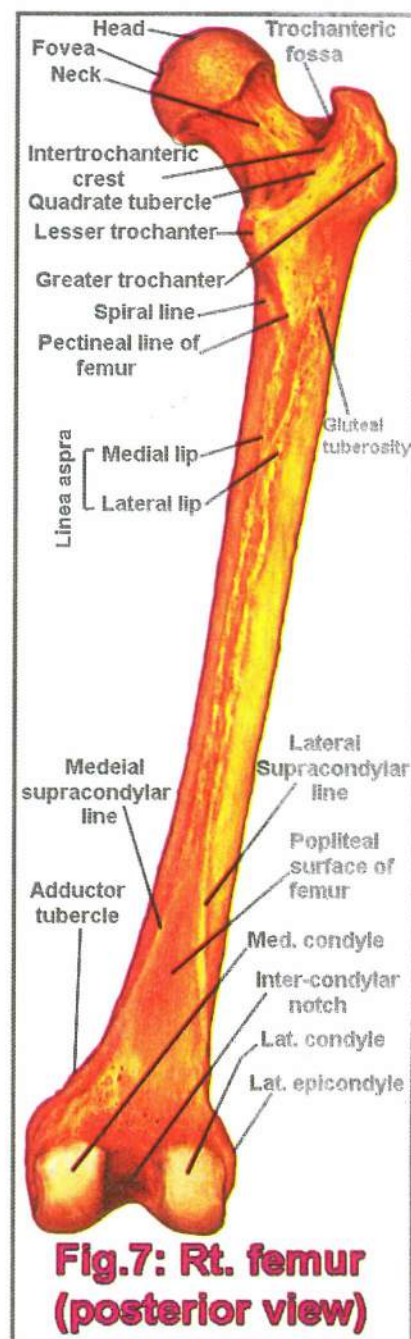
The back of the upper third shows a 4th surface exists between:

- Spiral line (medially). - Gluteal tuberosity (laterally).

The back of the lower third shows a 4<sup>th</sup> surface (popliteal surface) exists between: Med. & lat supracondylar lines.



**Fig. 6:  
Rt. femur  
(ant. view)**



**Fig. 7: Rt. femur  
(posterior view)**

### C- Lower end shows:

**1. Lateral condyle:**

- Is stronger than the medial one, lies in line with the shaft (body weight transmission).

- Is prominent anteriorly.

- It shows a small impression lies above (the lateral epicondyle) and a large groove lies below (for popliteus).



**2. Medial condyle:** Shows:

- Adductor tubercle.
- Medial epicondyle lies on its medial surface.

**3. Intercondylar area (notch):** Separates the condyles posteriorly.**4. Patellar surface:** The two condyles are fused anteriorly at this surface.**How to determine the side:**

We put the femur in anatomical position with:

- The head lies above & medially.
- The shaft is convex forwards.

**Subcutaneous parts of the femur:**

1. Greater trochanter.
2. Both condyles & epicondyles.
3. Adductor tubercle.

**Ossification of the femur:** There are:

- One primary center for the shaft.

- 4 secondary centers in:

- 1- Lower end (appears before birth in the 9th month).
- 2- Head.
- 3- Greater trochanter, appears after birth.
- 4- Lesser trochanter, appears after birth.

The neck ossifies as extension from the shaft.

**Blood supply of head of femur:**

- 1- Retinacular vessels, through the capsule of hip joint.
- 2- Artery along the ligamentum teres.
- 3- Nutrient artery (through the medullary canal).

**Particular features of the femur****A. Muscles attached**

Site	Muscle attached	O or I	Exact site of attachment
<b>Upper end</b> (8 insertions)	<b>Piriformis</b>	Insertion	Top of the greater trochanter.
	<b>Gluteus minimus</b>	Insertion	Anterior surface of the greater trochanter.
	<b>Gluteus medius</b>	Insertion	Posterosuperior angle & oblique ridge of the greater trochanter.
	<b>Obturator internus</b>	Insertion	Medial surface of the greater trochanter.
	<b>Obturator externus</b>	Insertion	Trochanteric fossa.
	<b>Quadratus femoris</b>	Insertion	Quadratus tubercle.
	<b>Gluteus maximus</b>	Insertion	Floor of the gluteal tuberosity.
	<b>Iliopsoas</b>	Insertion	Lesser trochanter.
<b>Shaft</b> (4 origins & 4 insertions)	<b>Vastus lateralis</b>	Origin	1- Upper part of intertrochanteric line. 2- Anterior and inferior borders of the greater trochanter. 3- Lateral lip of the gluteal tuberosity. 4- Lateral lip of the linea aspra.
	<b>Vastus medialis</b>	Origin	1- Upper part of intertrochanteric line. 2- Spiral line. 3- Medial lip of linea aspra. 4- Medial supracondylar line.
	<b>Vastus intermedius</b>	Origin	Upper 3/4 of anterior & lateral surfaces of the shaft.
	<b>Short H. of biceps</b>	Origin	Linea aspra & upper 1/2 of lateral supracondylar line.
	<b>Pectineus</b>	Insertion	Upper part of the line connecting lesser trochanter to linea aspra (pectineal line of femur).
	<b>Adductor longus</b>	Insertion	Middle 1/3 of linea aspra.
	<b>Adductor brevis</b>	Insertion	Lower part of pectineal line & upper part of linea aspra.
	<b>Adductor magnus (pubic part)</b>	Insertion	1- Medial lip of the gluteal tuberosity. 2- Medial lip of the linea aspra. 3- Medial supracondylar line.



Lower end (1 insertion & 4 origins)	Adductor magnus (ischial part)	Insertion	Adductor tubercle.
	Medial head of gastrocnemius	Origin	Popliteal surface of the femur above medial condyle.
	Lateral head of gastrocnemius	Origin	Lateral epicondyle.
	Plantaris	Origin	Lower 1/3 of the lateral supracondylar line.
	Popliteus	Origin	Anterior part of the groove below the lateral epicondyle.

### B. Ligaments attached

Ligament	Femur attachment
Round ligament of the head (ligamentum teres)	Fovea of the head.
Iliofemoral ligament	Upper & lower ends of the intertrochanteric line.
Tibial collateral ligament	Medial epicondyle of the femur.
Fibular collateral ligament	Lateral epicondyle of the femur.
Anterior cruciate ligament	Medial surface of the lateral condyle.
Posterior cruciate ligament	Lateral surface of the medial condyle.
Oblique popliteal ligament	Upper part of the back of the lateral condyle.

## The Patella (The largest sesamoid bone of the body)

It has: - **Base (above):** Receives insertion of quadriceps femoris.

- **Apex:** Gives attachment to ligamentum patellae.

- **Anterior surface:** Is rough.

- **Posterior surface:** Is smooth and articular. It is divided by a vertical ridge into 2 articular facets (the lateral is the larger and the medial is the smaller).

## The Tibia (Figs. 8 & 9)

**Site:** It is the medial bone of the leg.

**General features:** It is typical long bone with shaft and 2 ends.

### A. Upper end shows:

#### 1- Medial condyle:

- Is larger, more prominent posteriorly.
- Its upper articular surface is oval.
- There is a groove on its posterior surface (for semimembranosus).

#### 2- Lateral condyle:

- Is smaller.
- Its upper articular surface is circular.
- There is a facet on its lateral surface for articulation with the head of the fibula.

#### 3- Intercondylar area:

- Is divided into anterior and posterior parts by the intercondylar eminence.

#### 4- Tibial tuberosity : is anterior.

### B. Shaft shows 3 borders and 3 surfaces:

1) **Anterior border (shin):** Extends from the tibial tuberosity till the medial malleolus. It is subcutaneous.

2) **Medial border:** Extends from the medial condyle till the medial malleolus.



3) **Interosseous (lateral) border:** Is sharp.

4) **Medial surface:** Lies between the anterior and medial borders. It is subcutaneous.

5) **Lateral surface:** Lies between the anterior and lateral borders.

6) **Posterior surface:** Lies between medial and lateral borders.

This surface shows the soleal line (which crosses the back of tibia downwards and medially). The area below it shows a vertical line.

### C- Lower end (5 surfaces):

1) **Anterior surface:** Is continuous above with the lateral surface of the shaft.

2) **Medial surface:** Is continuous above with medial surface of the shaft. It projects below as the medial malleolus which contains on its lateral surface a facet situated at right angle to that of the lower end of tibia, it articulates with the medial side of the talus.

3) **Lateral surface (fibular notch):** It articulates with lower end of the fibula.

4) **Posterior surface:**

- Is continuous above with posterior surface of the shaft.
- Is marked by a groove for tibialis posterior tendon.

5) **Inferior surface:** Articulates with body of talus.

**How to determine the side:**  
We put the tibia in the anatomical position with:

- The 2 condyles of the tibia (above).
- Medial malleolus (medially).
- Tibial tuberosity & shin (anteriorly).

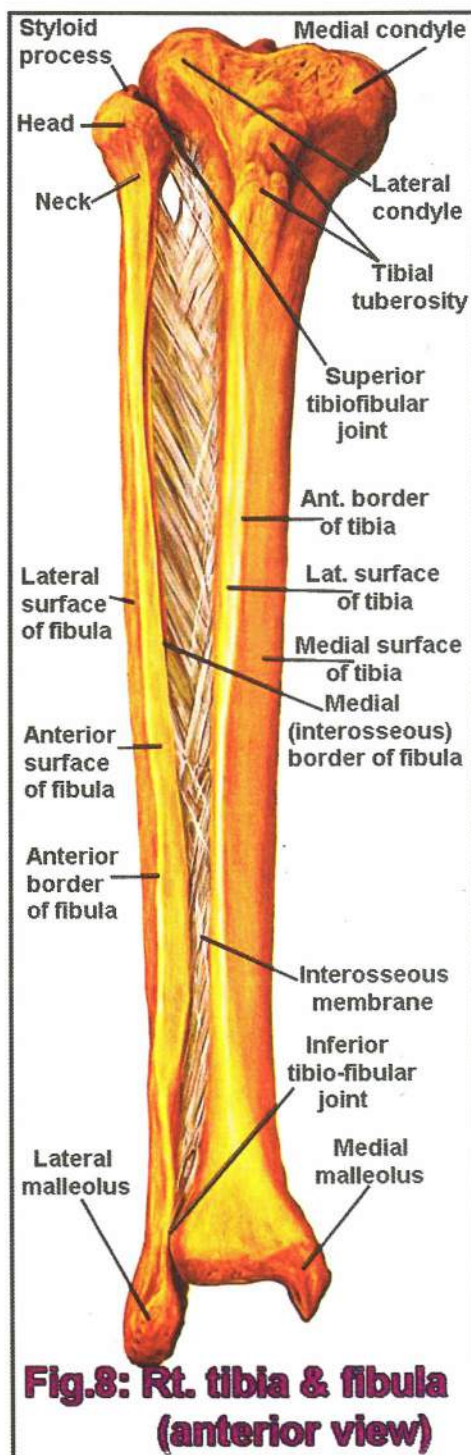
### Subcutaneous parts:

- Both condyles.
- Tibial tuberosity.
- Chin and medial surface.
- Medial malleolus.

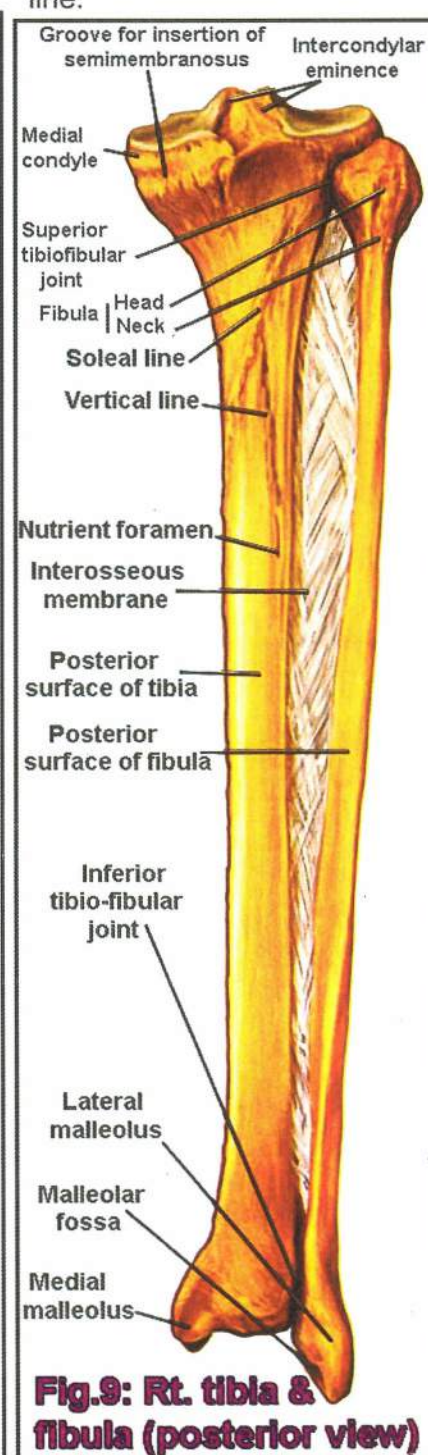
### Ossification of the tibia:

1. One primary center for the shaft.
2. Two secondary centers for the ends (that of the upper end appears at the time of birth).

N.B.: Tibial tuberosity may ossify by a separate center.



**Fig.8: Rt. tibia & fibula (anterior view)**



**Fig.9: Rt. tibia & fibula (posterior view)**



## Particular features of the tibia

### A. Muscles attached

Muscle attached	O or I	Exact site of attachment
Sartorius	Insertion	Upper part of the medial surface the tibia.
Gracilis	Insertion	Upper part of the medial surface the tibia behind sartorius.
Semitendinosus	Insertion	Upper part of the medial surface the tibia behind gracilis.
Semimembranosus	Insertion	Groove on back of the medial condyle.
Popliteus	Insertion	Back of the tibia above the soleal line.
Tibialis anterior	Origin	From upper 2/3 of the lateral surface of the shaft.
Soleus	Origin	From soleal line and middle 1/3 of the medial border.
Flexor digitorum longus	Origin	Back of the tibia below the soleal line, medial to the vertical line.
Tibialis posterior	Origin	Back of the tibia below the soleal line, lateral to the vertical line.

### B. Ligaments attached

Ligament	Tibial attachment
Lateral meniscus	Just in front & behind the intercondylar eminence.
Medial meniscus	- Anterior horn: Anterior most part of the anterior intercondylar area. - Posterior horn: Posterior intercondylar area in front of post. cruciate lig.
Anterior cruciate ligament	Anterior intercondylar area behind the anterior horn of the medial meniscus.
Posterior cruciate ligament	Posterior most part of the posterior intercondylar area.
Iliotibial tract	Anterolateral aspect of the lateral condyle.
Tibial collateral ligament	Medial surface of the medial condyle.
Ligamentum patellae	Tibial tuberosity.
Deltoid ligament	Tip of the medial malleolus.
Ligaments of the inferior tibiofibular joint	(Anterior, posterior & interosseous) are attached to the fibular notch of the tibia.

## The Fibula (Figs. 8 & 9)

**Site:** It is the lateral bone of the leg.

**General features:** It is typical long bone with shaft and 2 ends.

### A- Upper end (head)

- Is directed upwards, forwards and medially.
- It has an articular facet for articulation with lateral condyle of tibia (superior tibiofibular joint).
- It has styloid process which projects from its posterolateral aspect.

### B- Shaft has 3 borders & 3 surfaces:

1. **Anterior border:** It can be traced above as a continuation of the triangular area on the lateral surface of lateral malleolus.
2. **Interosseous border:** The nearest border to the anterior one and is separated from it by the anterior surface.
3. **Posterior border:** The border which is opposite to the anterior border and is separated from it by the lateral surface.
4. **Anterior surface (medial surface):** Lies between anterior and interosseous borders.
5. **Lateral surface:** Lies between anterior and posterior borders.



6. **Posterior surface:** Lies between interosseous and posterior borders. It is divided into 2 longitudinal areas by the medial crest.

### C- Lower end (lateral malleolus)

**Its lateral surface:** Presents a triangular area continuous above as the anterior border.

**Its posterior surface:** Contains a groove for peronei muscles.

**Its medial surface:** Contains: - **Facet:** For articulation with lateral surface of talus.

- **Malleolar fossa:** Lies below and behind the facet.

**How to determine the side:** We put the fibula in the anatomical position with:

- The head (above).
- The lateral surface of the lateral malleolus (laterally).
- The malleolar fossa (faces backwards & medially).

### Subcutaneous parts of the fibula:

- The head.
- The lateral malleolus (1 cm below the medial one).

### Ossification of the fibula:

- It has:
- One 1ry centre for the shaft.
  - Two 2ry centres for the ends.

### Functions of fibula:

The fibula does not articulate with femur, so it does not transmit body weight. Its functions are:

1. Gives muscular attachment.
2. Forms part of ankle joint.
3. Its lower end forms a pulley for tendons of peronei muscles.
4. It can be used as bone graft.

## Particular features of the fibula

### A. Muscles attached

Site	Muscle attached	O or I	Exact site of attachment
Lateral surface (3 muscles)	Biceps femoris	Insertion	Lateral surface of the head.
	Peroneus longus	Origin	Upper 2/3 of the lateral surface of the shaft.
	Peroneus brevis	Origin	Lower 2/3 of the lateral surface of the shaft.
Anterior surface (3 muscles)	Extensor digitorum longus	Origin	Upper 3/4 of the anterior surface of the shaft.
	Extensor hallucis longus	Origin	Middle 2/4 of the anterior surface of the shaft.
	Peroneus tertius	Origin	Lower 1/4 of the anterior surface of the shaft.
Posterior surface (3 muscles)	Soleus	Origin	Back of the head & upper 1/4 of the shaft.
	Flexor hallucis longus	Origin	Back of the fibula lateral to the medial crest.
	Tibialis posterior	Origin	Back of the fibula medial to the medial crest.

### B. Ligaments attached

Ligament	Fibular attachment
Fibular collateral ligament	Head of the fibula.
Calcaneofibular ligament	Tip of the lateral malleolus.
Ant. & post. tibiofibular lig.	Triangular area above the facet of the lower end.
Posterior talofibular lig.	Malleolar fossa.
Anterior talofibular lig.	Anterior border of the lateral malleolus.



## Bones of the foot (Fig.10)

### I. Tarsus (root of foot): Arranged in 3 rows.

#### A. Proximal row:

- **Talus:** Articulates forwards with navicular bone.
- **Calcaneus:** Articulates forwards with cuboid bone.

#### B. Intermediate row:

**Navicular:** Articulates forwards with the 3 cuneiform bones.

#### C. Distal row:

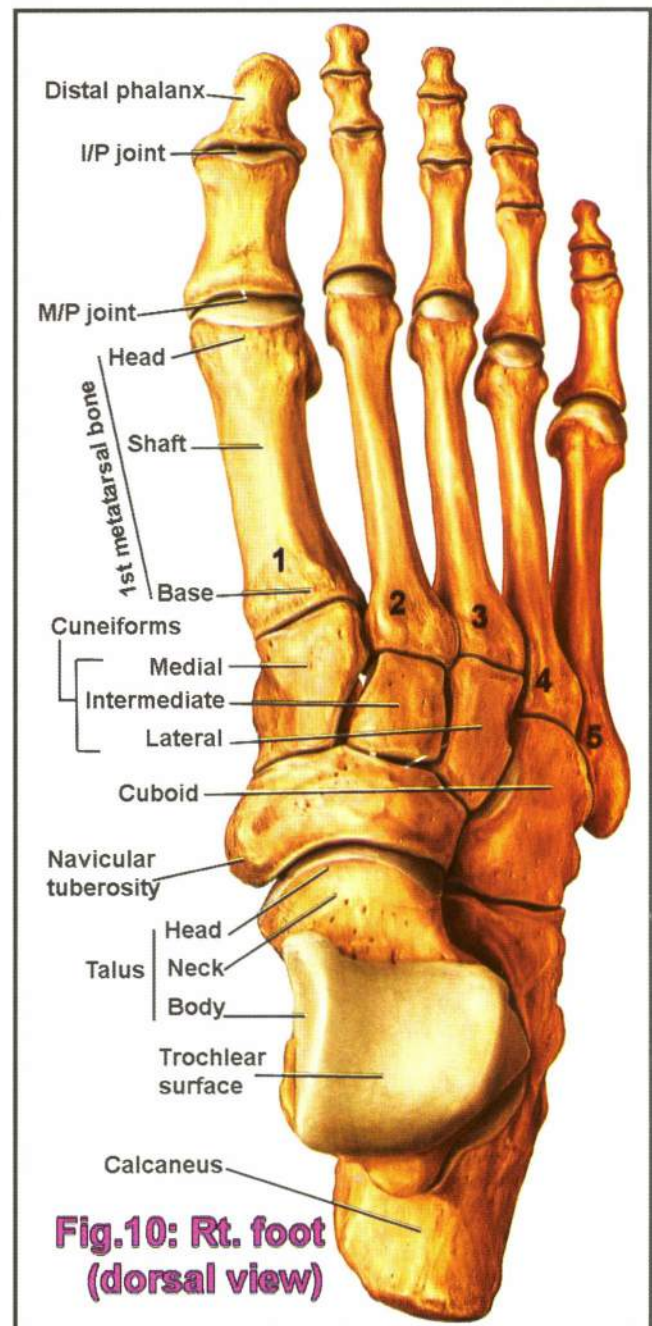
- **3 Cuneiforms:** Articulate forwards with the medial 3 metatarsals.
- **Cuboid:** Articulates forwards with the lateral 2 metatarsals.

### II. Metatarsus (middle of foot):

- 5 in number, one for each toe.

### III. Phalanges:

- 3 Phalanges in each toe except the big toe has only 2.









## II- Muscles of the Thigh

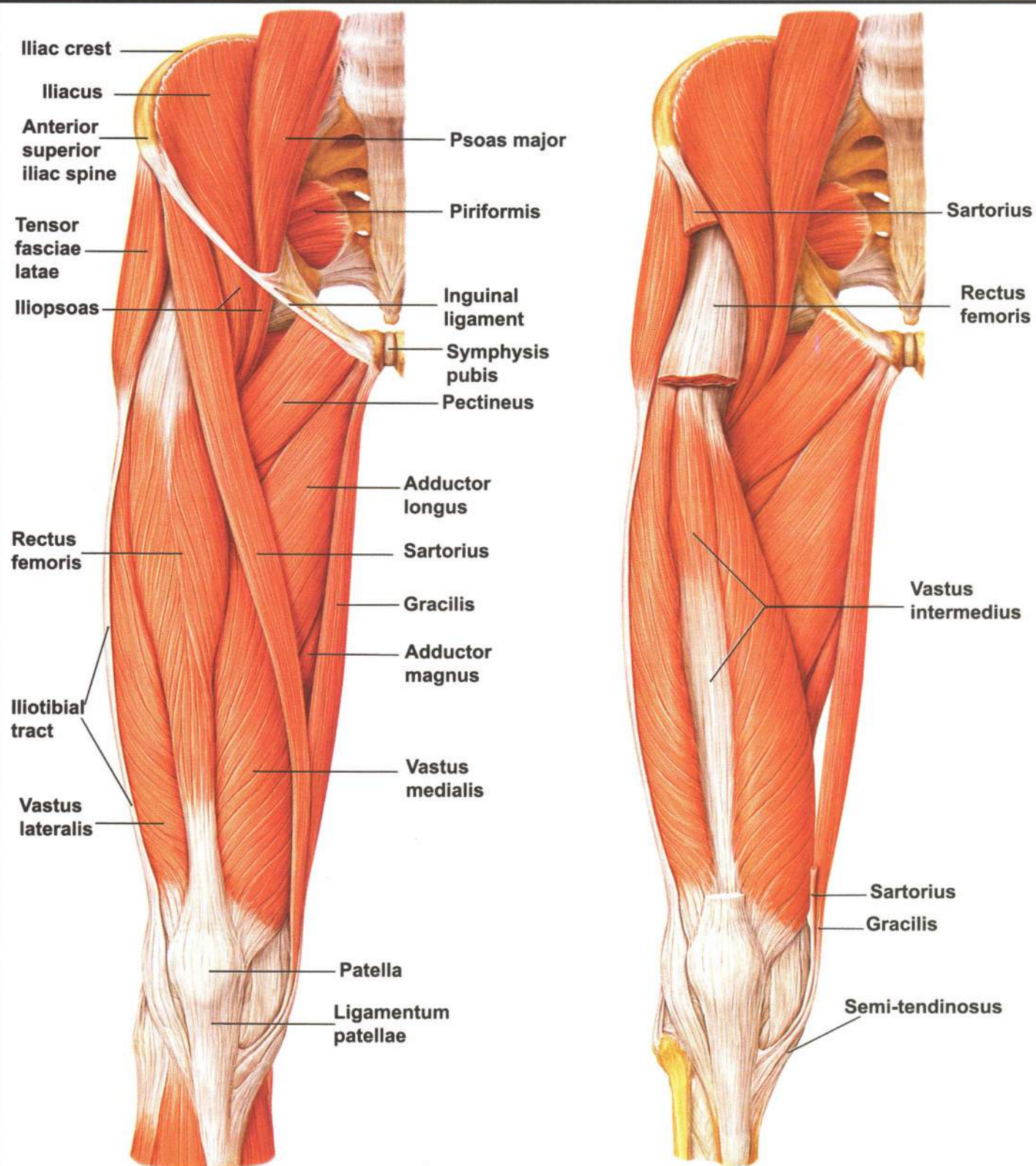
### A- Muscles of front of the thigh

Muscle	Origin	Insertion	N. Supply	Action
<b>1- Sartorius</b> (The longest muscle in the body). It is strap like.	Anterior superior iliac spine (ASIS), below attachment of the inguinal ligament.	Upper part of medial surface of shaft of tibia.	Femoral nerve.	- Flexion, abduction & lat. rot. hip. - Flexion & med. rotation knee (tailor's position). - Steadies pelvis.
<b>2- Quadriceps Femoris</b> (The biggest muscle in the body).	<b>a) Rectus femoris.</b> <u>Straight head</u> : anterior inferior iliac spine. <u>Reflected head</u> : groove above acetabulum & capsule of the hip.	The quadriceps femoris tendon is inserted in: 1- Base of the patella. 2- Tibial condyles by patellar retinaculae. 3- Tibial tuberosity via ligamentum patellae. 4- Capsule of knee. 5- Synovial membrane of knee joint by articularis genu.	Femoral nerve. " Each head receives 2-3 branches" - Branches to rectus femoris supply the hip joint. - Branches to vasti supply the knee joint.	1 - Powerful extension of knee. 2 - Rectus femoris can flex hip joint. 3 - Articularis genu draws the synovial membrane upwards during knee extension preventing its crushing. 4- Lower fibers of the vastus medialis stabilize the patella against the lateral pull of the ilio-tibial tract.
	<b>b) Vastus lateralis.</b> (The largest head). - Intertrochanteric line (upper part) - Root of greater trochanter. - Lateral lip of gluteal tuberosity. - Lat. lip of linea aspra. - Lateral intermuscular septum.			
	<b>c) Vastus medialis.</b> - Intertrochanteric line (lower part) - Spiral line. - Med. lip of linea aspra. - Medial supracondylar line. - Medial intermuscular septum.			
	<b>d) Vastus intermedius</b> - Upper $\frac{2}{3}$ of ant., lat. surface of shaft of femur. - Few fibers arise separately below (articularis genu).			

### B- Muscles on medial side of the thigh

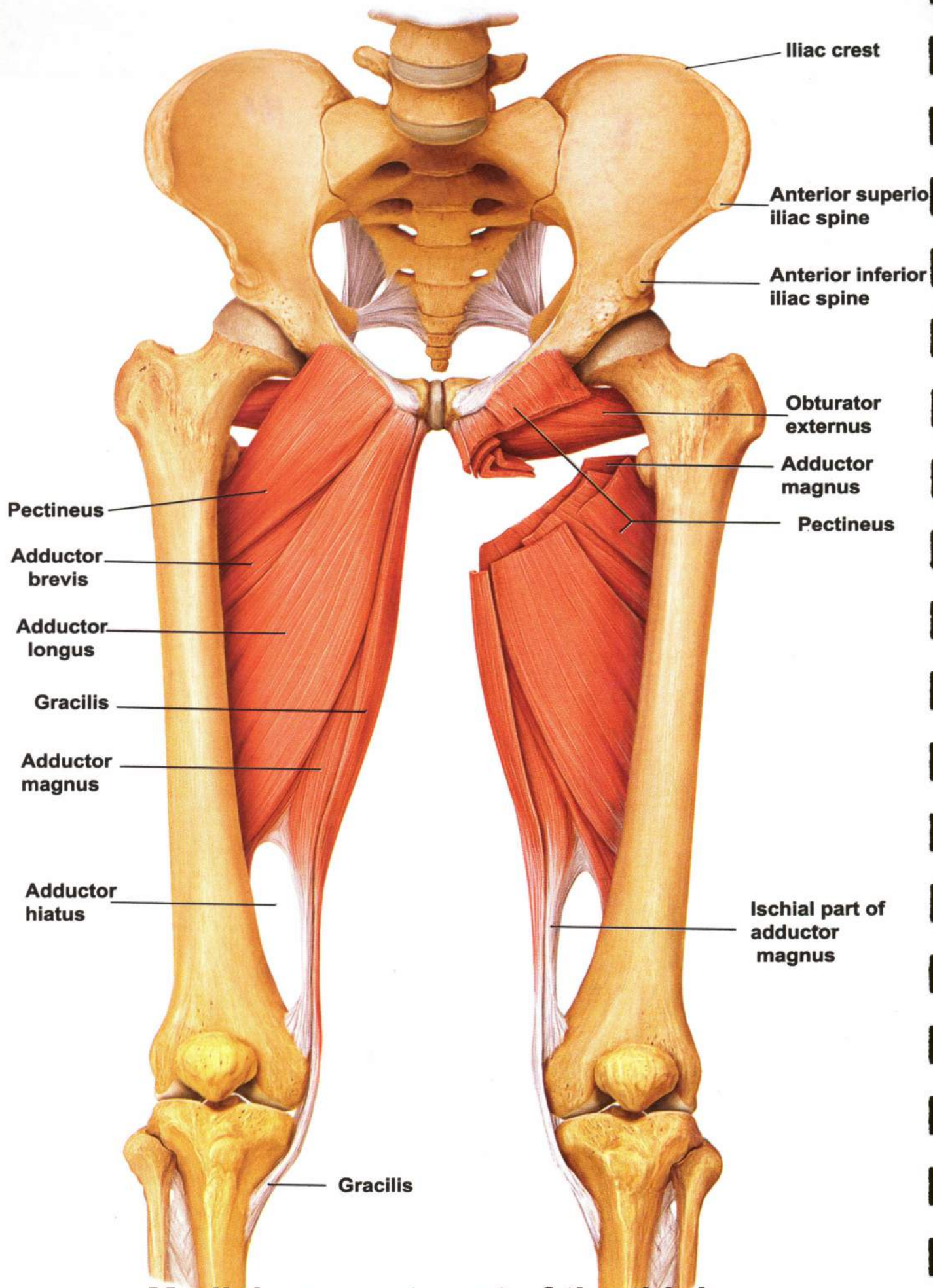
Muscle	Origin	Insertion	N Supply	Action
<b>1- Gracilis</b> It is the medial most muscle of the thigh.	- Body of the pubis. - Outer surface of conjoint ramus.	Upper part of medial surface of shaft of tibia between sartorius & semitendinosus).	Anterior division of obturator nerve.	- Adduction thigh. - Flexion knee. - Medial rotation of flexed knee. - Steadies pelvis.
<b>2- Pectineus</b>	Pectineal surface, line of superior pubic ramus.	Upper $\frac{1}{2}$ of pectineal line of femur.	Femoral or obturator or accessory obturator N.	- Adduction thigh. - Flexion thigh.
<b>3- Adductor longus</b> Its lower part may ossify (Rider's bone)	Outer surface of body of pubis below pubic tubercle.	Middle $\frac{1}{3}$ or $\frac{2}{4}$ of linea aspra.	Anterior division of obturator N.	- Adduction thigh. - Medial rotation of flexed thigh.
<b>4- Adductor brevis</b>	Outer surface of: - Body of pubis. - Inf. pubic ramus.	- Lower $\frac{1}{2}$ of pectineal line of femur. - Linea aspra.	Obturator N. (anterior or posterior division).	





**Muscles of anterior & medial compartments of the thigh**





**Medial compartment of the thigh**



<b>5- Adductor magnus</b>	<b>Pubic (adductor) part:</b>	Outer surface of: - Inf. pubic ramus. - Ischial ramus.	Medial lip of gluteal tuberosity, medial lip of linea aspra & medial supracondylar line.	Posterior division of obturator N.	
	<b>Ischial (hamstring) part:</b>	Lateral ½ of lower triangular part of ischial tuberosity.	Adductor tubercle & adjoining area of medial supracondylar line.	Sciatic nerve.	Extension of hip joint.
<b>6- Obturator externus</b>		- Obturator foramen.	Trochanteric fossa. "The tendon passes below, behind hip joint".	Posterior division of obturator N.	Lateral rotation of thigh.

### C- Muscles on back of the thigh (Hamstrings)

	<b>1- Semimembranosus</b>	<b>2- Semitendinosus</b>	<b>3- Biceps Femoris</b>
<b>Origin</b>	Upper lateral area of the upper quadrangular part of the ischial tuberosity. (Its upper ½ is membrane).	Lower medial area of the upper quadrangular part of ischial tuberosity. (Its lower ½ is tendon).	- <u>Long head</u> : Common origin with semitendinosus. - <u>Short head</u> : 1- Linea aspra. 2- Upper ½ of Lat. supracondylar line.
<b>Insertion</b>	- Groove on back of medial condyle of tibia. - Capsule of the knee. - Fascia on popliteus.	Upper part of medial surface of tibia behind gracilis, sartorius.	Head of the fibula.
<b>Nerve Supply</b>	Tibial (medial popliteal) part of the sciatic nerve.		- Long head: Tibial part of sciatic N. - Short head: Common peroneal part of sciatic N.
<b>Action</b>	1- Extension hip joint.      2- Flexion knee joint. 3- Medial rotation of flexed knee.		3- Lateral rotation of flexed knee.

## III- Regions of the Thigh

### A- Femoral Triangle

**It is:** Inverted triangular hollow in upper ⅓ of front of thigh.

**Boundaries:**

- **Base (above):** inguinal ligament.
- **Medial boundary:** Medial border of adductor longus.
- **Lateral boundary:** Medial border of sartorius.
- **Apex (below):** Meeting of medial & lateral boundaries.
- **Floor:** Iliacus, psoas major, pectineus & adductor longus.
- **Roof:**

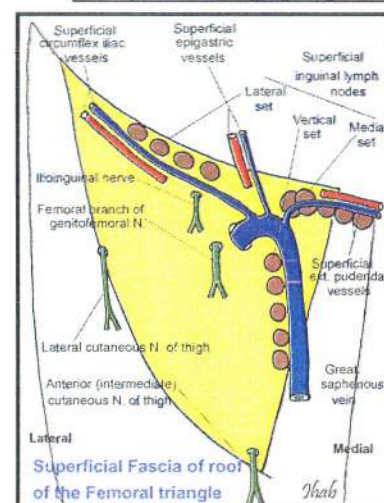
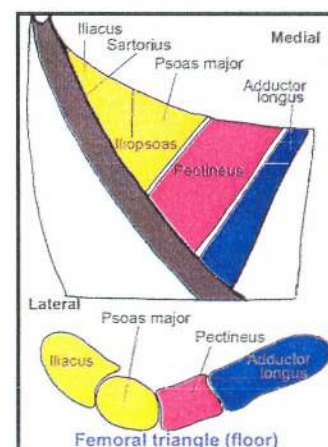
- Skin, superficial & deep fasciae.
- The superficial fascia contains:

1 **group of lymph nodes:** Superficial inguinal LN. It is formed of 2 groups: vertical group: along the great saphenous vein & horizontal group: below and parallel to the inguinal ligament.

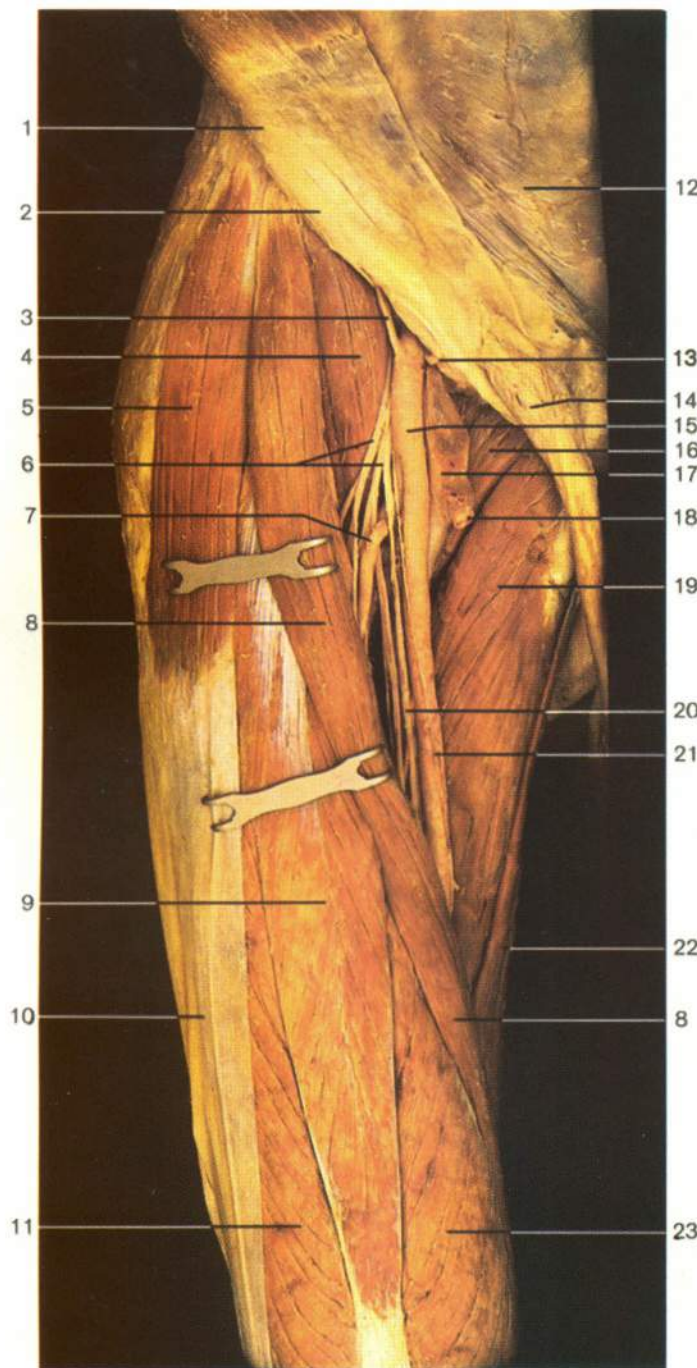
2 **nerves:** Ilioinguinal & femoral branch of genitofemoral.

3 **Arteries:** Superficial ext. pudendal, epigastric & circumflex iliac.

4 **Veins:** Great saphenous vein + 3 tributaries correspond to arteries.

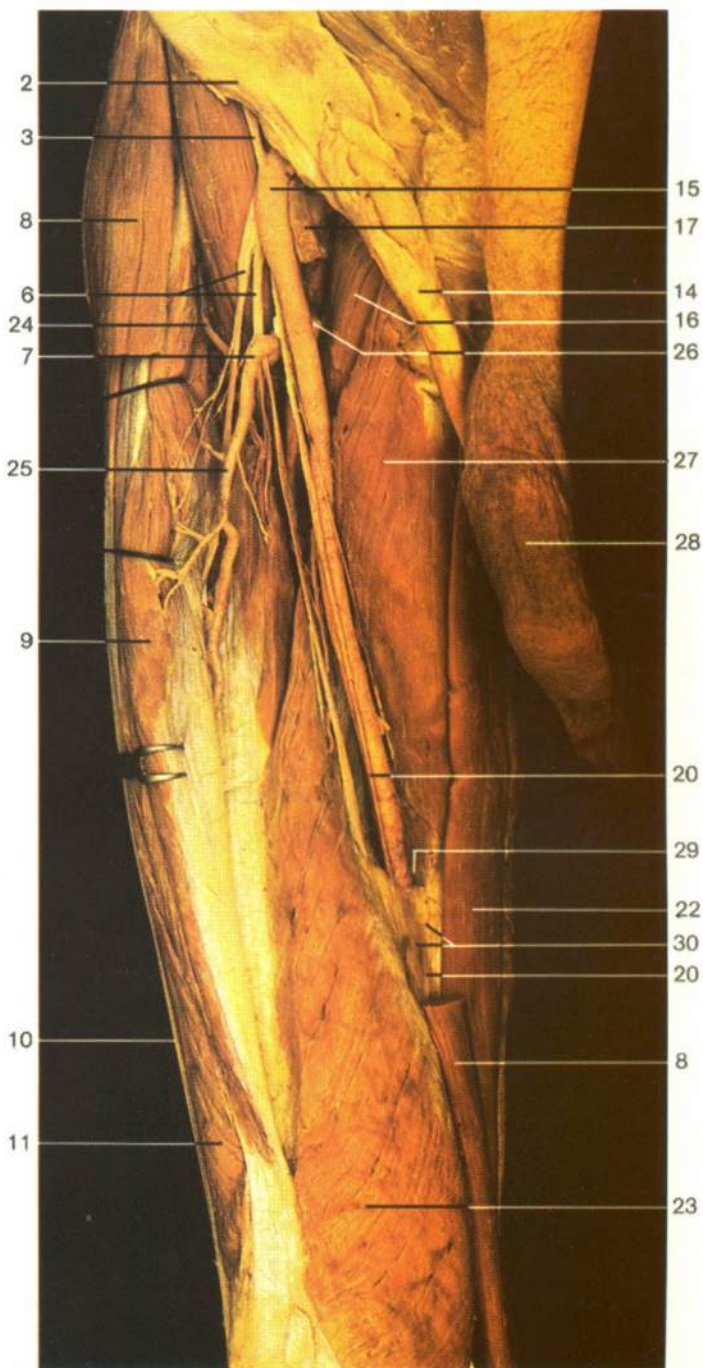






**Anterior region of right thigh (anterior aspect).**

The fascia lata has been removed, and the sartorius muscle has been slightly reflected.



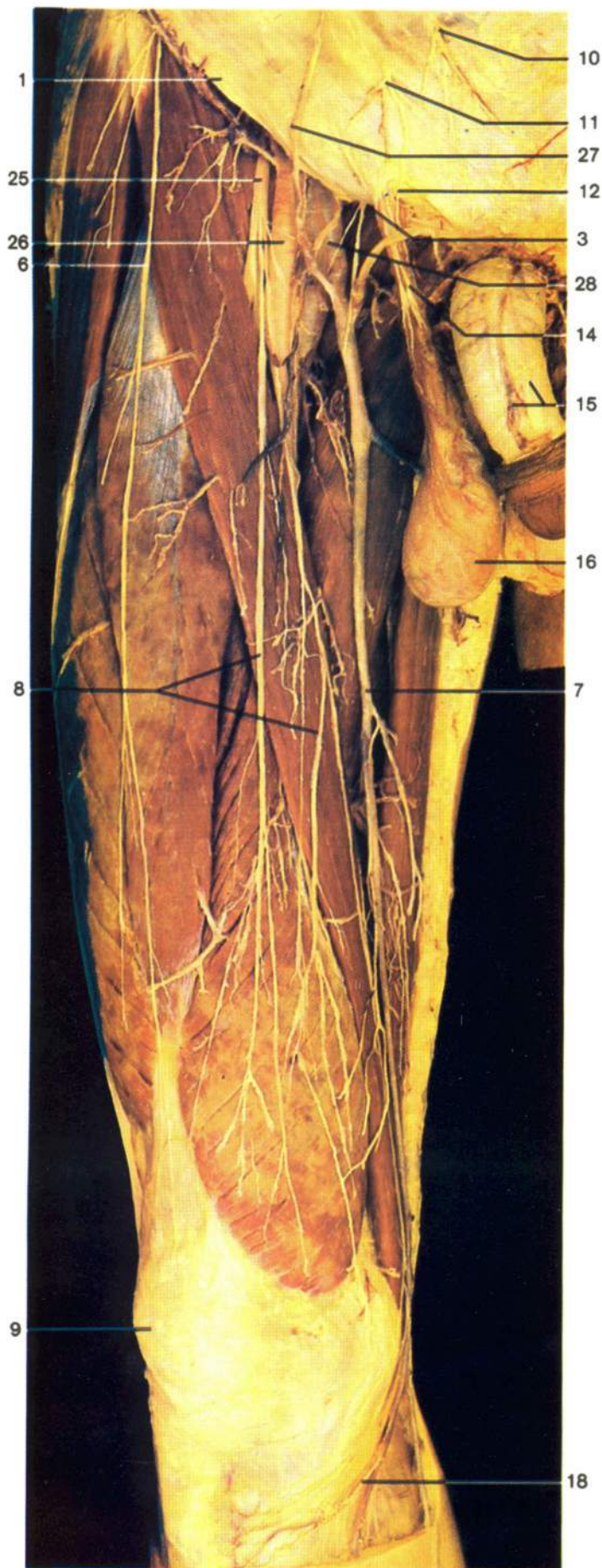
**Anterior region of right thigh (anterior aspect).**

The fascia lata has been removed, and the sartorius muscle has been divided.

- 1 Anterior superior iliac spine
- 2 Inguinal ligament
- 3 **Deep circumflex iliac artery**
- 4 Iliopsoas muscle
- 5 Tensor fasciae latae muscle
- 6 **Femoral nerve**
- 7 **Lateral circumflex femoral artery**
- 8 Sartorius muscle
- 9 Rectus femoris muscle
- 10 Iliotibial tract
- 11 Vastus lateralis muscle
- 12 Anterior sheath of rectus abdominis muscle
- 13 Inferior epigastric artery
- 14 Spermatic cord
- 15 **Femoral artery**

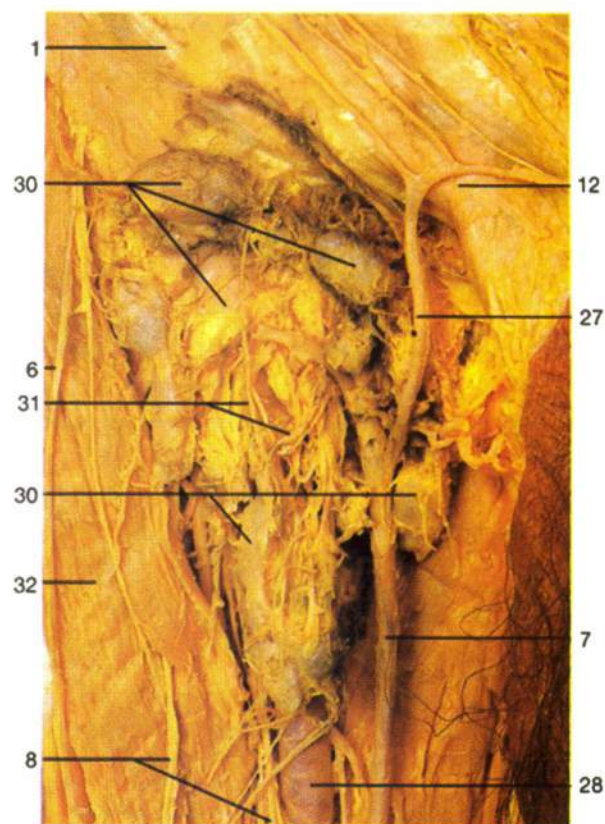
- 16 Pectineus muscle
- 17 **Femoral vein**
- 18 Great saphenous vein (divided)
- 19 Adductor longus muscle
- 20 **Saphenous nerve**
- 21 Muscular branch of femoral nerve
- 22 Gracilis muscle
- 23 Vastus medialis muscle
- 24 Ascending branch of lateral circumflex femoral artery
- 25 Descending branch of lateral circumflex femoral artery
- 26 Medial circumflex femoral artery
- 27 Adductor longus muscle
- 28 Penis
- 29 Entrance to adductor canal
- 30 Vastoadductory lamina of fascia beneath sartorius muscle





**Cutaneous nerves and veins of thigh (anterior aspect).**  
The fascia lata and fasciae of the thigh muscles have been removed.

- 1 Inguinal ligament
- 2 Superficial circumflex iliac vein
- 3 Femoral branch of genitofemoral nerve
- 4 Superficial inguinal lymph nodes
- 5 Saphenous opening with femoral artery and vein
- 6 Lateral femoral cutaneous nerve
- 7 Great saphenous vein
- 8 Anterior cutaneous branches of femoral nerve
- 9 Patella
- 10 Terminal branches of subcostal nerve
- 11 Terminal branches of iliohypogastric nerve
- 12 Superficial inguinal ring
- 13 External pudendal vein
- 14 Spermatic cord with genital branch of genitofemoral nerve
- 15 Penis with superficial dorsal vein of penis
- 16 Testis and its coverings
- 17 Saphenous nerve
- 18 Infrapatellar branch of saphenous nerve
- 19 Lateral sural cutaneous nerves
- 20 Intermediate dorsal cutaneous branch of superficial peroneal nerve
- 21 Cutaneous branch of obturator nerve
- 22 Superficial peroneal nerve
- 23 Medial dorsal cutaneous branch of superficial peroneal nerve
- 24 Deep peroneal nerve
- 25 **Femoral nerve**
- 26 **Femoral artery**
- 27 Superficial epigastric vein
- 28 **Femoral vein**
- 29 Lateral dorsal cutaneous branch of sural nerve
- 30 **Inguinal nodes (enlarged)**
- 31 Lymphatic vessels
- 32 Sartorius muscle



**Inguinal nodes with lymphatic vessels (anterior aspect).**



**Contents:**

1- **Femoral sheath:** funnel shaped fascial sheath, surrounds upper 3-4 cm of the femoral vessels.

2- **Arteries:**

1- **Femoral artery:** In lateral compartment of the femoral sheath.

2- **Five of the branches of the femoral artery:**

- a) Profunda femoris A. + medial & lateral circumflex femoral br.
- b) Deep external pudendal      c) 3 superficial inguinal arteries.

3- **Veins:**

- 1- Femoral vein: in intermediate compartment of femoral sheath.
- 2- Profunda femoris vein ends in the femoral vein.
- 3- Lateral & medial circumflex femoral veins end in femoral vein.

4- **Nerves:**

- 1. Lateral cutaneous nerve of the thigh: medial to the anterior superior iliac spine.
- 2. Femoral nerve (lateral to femoral artery, in iliopsoal groove).
- 3. Femoral branch of genitofemoral N.: in lateral compartment of the femoral sheath.

5- **Deep inguinal LNs & Fat:** 2-3 nodes in the femoral canal.

**Femoral sheath**

It is funnel shaped sheath, surrounds the upper 3-4 cm (1½ inches) of the femoral vessels.

**Walls of the femoral sheath:**

- **Anterior wall:** Formed by fascia transversalis (lines the transversus abdominis).
- **Posterior wall:** Formed by fascia iliaca (lines the iliacus).

**Compartments & Contents:** Two antero-posterior septa divide the space inside the sheath into:

**Lateral compartment:** contains: femoral artery and femoral branch of genitofemoral nerve.

**Intermediate compartment:** contains femoral vein.

**Medial compartment:** Femoral canal.

**Femoral Canal:**

It is the medial compartment of the femoral sheath (3-4 cm).

It is related anteriorly to cribriform fascia & posteriorly to pectineus, its fascia.

Its lower end (apex) is closed by apposition of walls.

Its upper end (base): is closed by femoral septum.

The femoral septum is surrounded by the femoral ring which is bounded by:

**Anteriorly:** Inguinal ligament.

**Posteriorly:** Pectineal line, fascia covering pectineus.

**Laterally:** Femoral vein.

**Medially:** Crescentic sharp border of lacunar ligament. In 30% of people, abnormal obturator A. runs along this border (may be injured in femoral hernia operation).

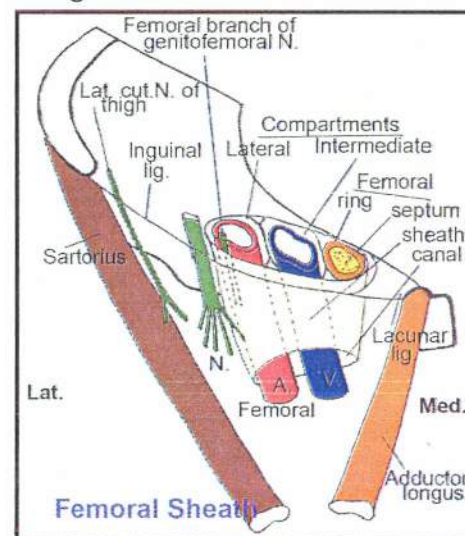
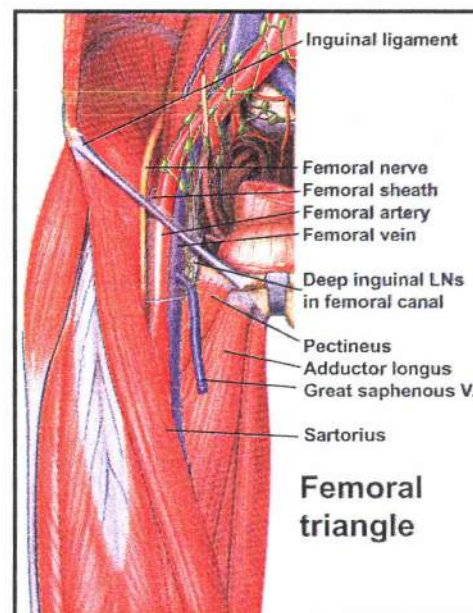
**Femoral canal contains:**

- 1- Loose areolar tissue & fat.
- 2- Deep inguinal LNs (one of them is the lymph node of Cloquet).
- 3- Afferents from the deep inguinal LNs.

**Advantages of the femoral canal:**

- 1- Acts as dead space, along side of the femoral vein allowing its expansion.
- 2- It contains lymph nodes & vessels (pathway of lymph vessels from LL to the abdomen).

**Disadvantages:** weak area, may allow femoral hernia.





## Femoral hernia

**Definition:** Abnormal protrusion of a peritoneal pouch through the femoral canal.

**Coverings:**

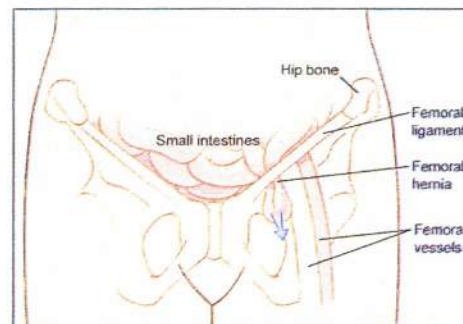
1. Femoral septum.
2. Anterior wall of the femoral sheath.
3. Cribriform fascia.
4. Superficial fascia & skin.

**It occurs more in females** as the femoral canal is wider due to:

- a. Wide pelvis.
- b. Small femoral vessels.
- c. Muscles are weaker.

**Direction of descent of the femoral hernia (U-shaped course):**

- A. Downwards in the femoral canal.
- B. Forward, pushing anterior wall of femoral sheath.
- C. Finally upwards and laterally "not below due to fascial adhesion below the inguinal ligament".



## B- Adductor Canal (Subsartorial or Hunter canal)

**It is** an intermuscular space, in the middle third of anteromedial side of the thigh.

**It begins** at the apex of the femoral triangle, descends backwards & medially.

**It ends** at adductor hiatus (an opening in adductor magnus) to communicate with popliteal fossa.

**Surface Anatomy:** It corresponds to the middle  $\frac{1}{3}$  of the line drawn extending from midinguinal point to adductor tubercle.

**Boundaries:** Triangular in cross section:

- **Antero-lateral wall:** Vastus medialis.
- **Posterior wall:** Adductor longus & magnus.
- **Roof (antero-medial wall):** 1- Sartorius.  
2- Fibrous arch bet. vastus medialis & adductors.

**Contents of adductor canal:**

1. **Femoral artery:**

- It traverses the canal from upper to its lower ends.
- It gives its **descending genicular** branch "near lower end of the canal" to supply the knee joint.

2. **Femoral vein:** Traverses the canal from the lower to the upper ends.

It enters the canal posterolateral, leaves it posterior to the femoral artery.

3. **Saphenous nerve:** It crosses the artery from lateral to medial.

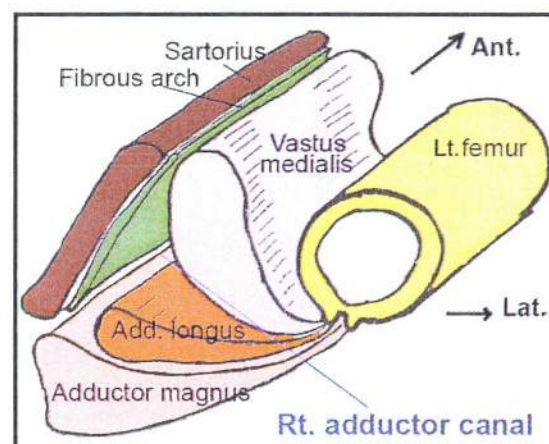
4. **Nerve to vastus medialis:** It enters the canal lateral to the femoral A., ends in vastus medialis.

5. **Subsartorial plexus of nerves:**

It lies deep to sartorius. It supplies skin on medial side of thigh.

It is formed of: 1- Medial cutaneous N. of thigh.

2- Saphenous N. 3. Anterior division of obturator N.

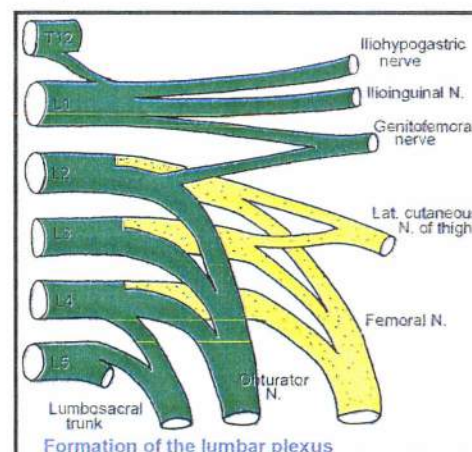


## IV- Nerves of the Thigh

### A- Lumbar plexus

**Site and mode of formation:**

- It lies within psoas major muscle in the abdomen.
- It is formed by the anterior primary rami of the upper 3 lumbar nerves and the greater part of L4.





- L1 receives a contribution of T12 nerve.
- The rest of the L4 nerve will form with the L5 nerve the lumbosacral trunk (in sacral plexus).
- N.B.: L4 shares in lumbar & sacral plexuses (nervous furcalis).

### The usual mode of formation:

- **L1 nerve gives:** 1) Large division gives:
  - Iliohypogastric N.: to skin of the anterior abdominal wall.
  - Ilioinguinal nerve: To external genitalia & medial side of thigh.
- 2) Small division: Joins L2 forming genitofemoral N.:
  - It divides into: -Genital branch: To cremasteric muscle.
  - Femoral branch: To skin of roof of femoral triangle.
- **L2, 3 & 4** divide into ventral and dorsal divisions:
  - i) Dorsal 2, 3 → Lat. cutaneous nerve of thigh to skin on lateral side of the thigh.
  - ii) Dorsal 2, 3, 4 → Femoral nerve.
  - iii) Ventral 2, 3, 4 → Obturator nerve.
  - iv) Ventral 3, 4 → Accessory obturator N. (occasional).

### Exit of branches of lumbar plexus from psoas major:

- A. In front of psoas: Genitofemoral N.
- B. At its medial aspect: - Obturator N. & lumbosacral trunk.  
- Accessory obturator N. (if present).
- C. At its lateral aspect (from above downwards):
  - Above the iliac crest: 1- Iliohypogastric N. 2- Ilioinguinal N.
  - Below the iliac crest: 1- Lateral cutaneous nerve of thigh. 2- Femoral nerve.

## **B- Femoral nerve** (The largest branch of the lumbar plexus)

**Root value:** dorsal divisions of L2, 3, 4.

**Surface anatomy:** It is represented by a vertical line (1 inch long) from the middle inguinal point.

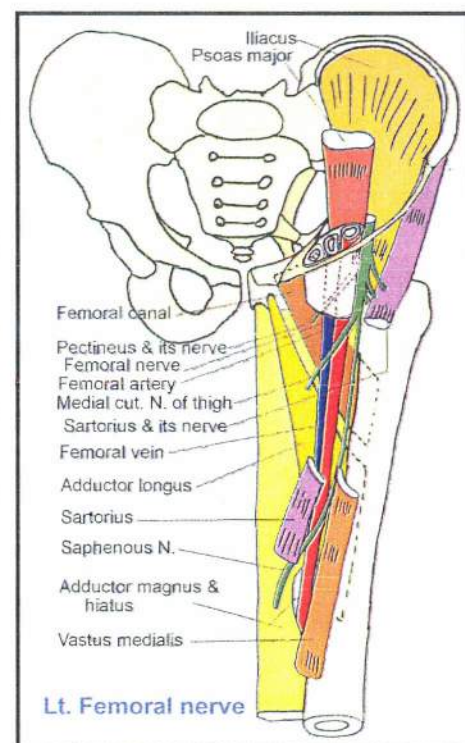
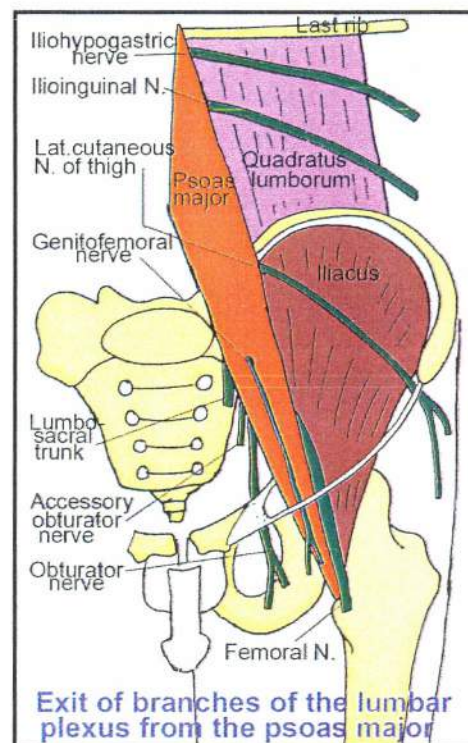
### Course & Relations:

- It leaves the psoas major muscle at the lower part of its lateral border.
- It descends in the iliopsoal groove (deep to fascia iliaca) to enter thigh behind the inguinal ligament.
- It is lateral to the femoral artery, outside the femoral sheath, for 2 cm below the inguinal ligament.
- In the thigh it divides by the lateral circumflex femoral artery into anterior and posterior divisions.

### Branches:

#### In the abdomen:

- To iliacus.
- To pectineus, passes behind femoral sheath.





**In the thigh: Anterior division gives:****- Cutaneous:**

1. Medial cutaneous nerve of thigh: to medial side of thigh.
2. Intermediate (anterior) cutaneous N. of thigh: to front of thigh.

**- Muscular to:** Sartorius muscle.**Posterior division gives:****- Muscular to:** Quadriceps femoris muscle.**- Articular to:** Hip joint (by nerve to rectus femoris) and to knee joint (by nerves to vasti muscles).**- Cutaneous:** Saphenous N.**Saphenous nerve****- Arises** from the posterior division of femoral nerve (the longest nerve in the body).**- In the femoral triangle**, it descends lateral to the femoral A.**- In the adductor canal**: It lies at first lateral to the artery.

Then, it crosses the artery from lateral to medial.

It leaves the adductor between sartorius and gracilis.

It gives its infrapatellar branch.

**- In the leg**: It descends on medial side of leg, accompanied with the great saphenous vein.**- In the foot**: It runs in front of medial malleolus (anterior to the great saphenous vein).

It ends at the level of metatarso-phalangeal joint of the big toe.

**- Branches**: 1. To patellar plexus & subsartorial plexus. 2. Skin on medial side of the leg & foot.**Injury of the femoral nerve** is rare, causing:

A) **Motor effects**: Paralysis of quadriceps femoris → loss of extension of knee joint.

B) **Sensory effects**: Loss of sensation in front, medial side of thigh & medial side of the leg, foot.

**C- Obturator nerve** (nerve of adductor compartment)

**Root value**: ventral division of L 2, 3, 4.

**Course & Relations:**

- It emerges from medial aspect of psoas major muscle on ala of the sacrum.

- It runs downwards, forwards on the wall of the pelvis to reach the upper part of obturator foramen.

- It traverses obturator canal above obturator A. & V.

- At the anterior end of the canal, **it divides into anterior and posterior divisions**:

**Anterior division:**

It passes in front of adductor brevis, behind pectineus and adductor longus muscles.

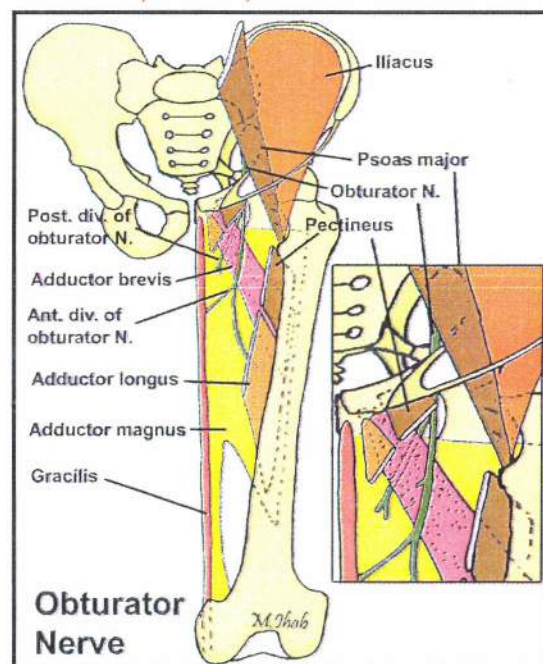
It gives the following branches:

○ **Muscular to**: 1- Adductor longus.

2 - Adductor brevis. 3- Gracilis 4- Pectineus.±

○ **Cutaneous to** lower part of medial aspect of thigh (subsartorial plexus).

○ **Articular to**: hip joint.





**Posterior division:**

- It pierces the obturator externus, in front of adductor magnus and behind adductor brevis.
- It gives the following branches:

- o **Muscular to:** - Pubic part of adductor magnus.  
- Adductor brevis. - Obturator externus.
- o **Articular to:** Knee joint.

**- Accessory obturator N. (L3, 4):**

- Is present in 30% as an aberrant fibers of obturator N.
- It crosses superior pubic ramus (doesn't enter obturator F.).
- It supplies the pectineus & hip joint.

- **Irritation of the obturator N.** by oophoritis may cause shooting pain on medial side of the thigh.

**V- Arteries of the thigh****1- Femoral artery**

**It begins** behind the mid inguinal point as the continuation of external iliac artery.

**Course:** - Its upper ½ lies in the femoral triangle, its lower ½ lies in the adductor canal.  
- Its upper 3-4 cm lies in the femoral sheath.

**It ends** at the junction of middle & lower thirds of thigh by passing through opening in adductor magnus (adductor hiatus) to become popliteal A.

**Relations: In femoral triangle:**

**- Anteriorly:**

1. Skin, fasciae and femoral sheath.
2. Femoral branch of genito femoral N. (is anterolateral to the artery).
3. Medial cutaneous nerve of thigh.

**- Posteriorly:**

1. Psoas major (separates it from head of femur).
2. Pectineus and its nerve.
3. Adductor longus & femoral vein.

**- Laterally:** Femoral & saphenous nerves.**- Medially:** Femoral vein (above).

**In adductor canal:**

**- Anteriorly:** 1. Skin, fasciae.

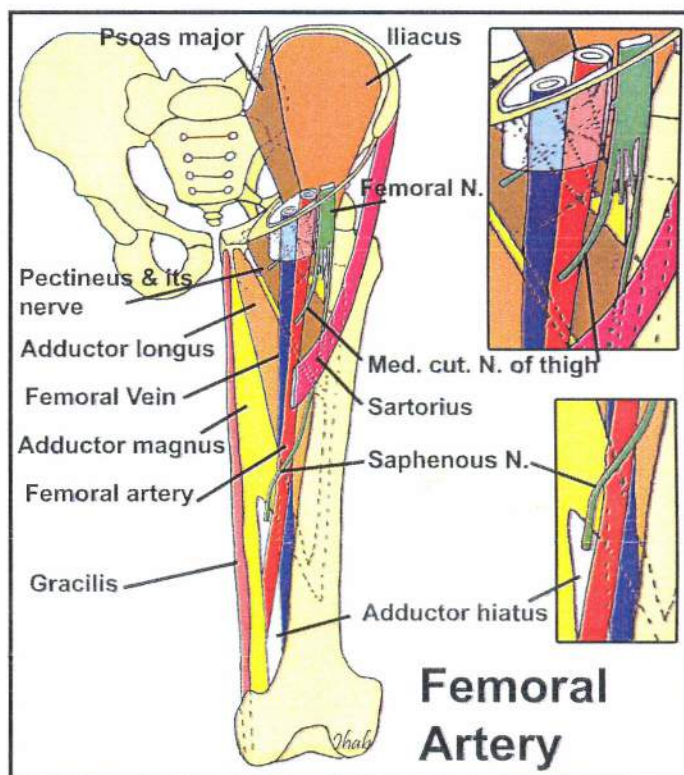
2. Sartorius, fibrous roof of adductor canal.
3. Saphenous N. (crosses it from Lat. to medial).

**- Posteriorly:**

- 1- Adductor longus & magnus.
- 2- Femoral vein (in the upper part of the canal).

**- Laterally:**

- 1- Vastus medialis and its nerve.
- 2- Femoral vein (in lower part of the canal).

**- Medially:** Saphenous nerve (in lower part of the canal).

**Mid inguinal point** is midway between anterior superior iliac spine & symphysis pubis. .

**Mid point of inguinal ligament (middle inguinal point)** is midway between ASIS & pubic tubercle.



**Branches of femoral artery:****A- Superficial branches**

They pierce the cribriform fascia, run in the superficial fascia.

- 1- **Superficial epigastric:** Ascends on the anterior abdominal wall.
- 2- **Superficial circumflex iliac:** reaches the anterior superior iliac spine.
- 3- **Superficial external pudendal:** Runs medially to external genitalia.

**B- Deep branches**

- 1- **Deep external pudendal:** Passes medially to external genitalia.
- 2- **Descending genicular A.:** The lowest branch arises in the adductor canal.

It gives: a) Muscular branches. b) Saphenous A.  
c) Articular to knee (arteria anastomotica magna).

3- **Profunda femoris (deep femoral):** the main supply of the thigh.

**Origin:** It arises from the posterolateral aspect of femoral artery 4 cm below the inguinal ligament.

**Course & Relations:**

- It passes laterally, then downwards, medially.
- It crosses iliopsoas & pectineus.
- It descends between adductor longus & brevis "adductor longus separates it from femoral A."
- Then it descends between adductor longus & magnus.

**It ends** a little below mid thigh as the 4<sup>th</sup> perforator.

**Branches:****A. Lateral circumflex femoral:**

- It runs laterally among branches of femoral nerve.
- It gives:
  - \* **Ascending branch** shares in anastomosis at anterior superior iliac spine.
  - \* **Transverse branch** shares in cruciate anastomosis.
  - \* **Descending branch** shares in anastomosis around knee.

**B. Medial circumflex femoral:** It gives:

- \* **Ascending branch**, shares in cruciate anastomosis.
- \* **Acetabular branch**, to the hip joint.
- \* **Transverse branch**, shares in the cruciate anastomosis.

**C. Perforating branches:** To muscles on back of the thigh:

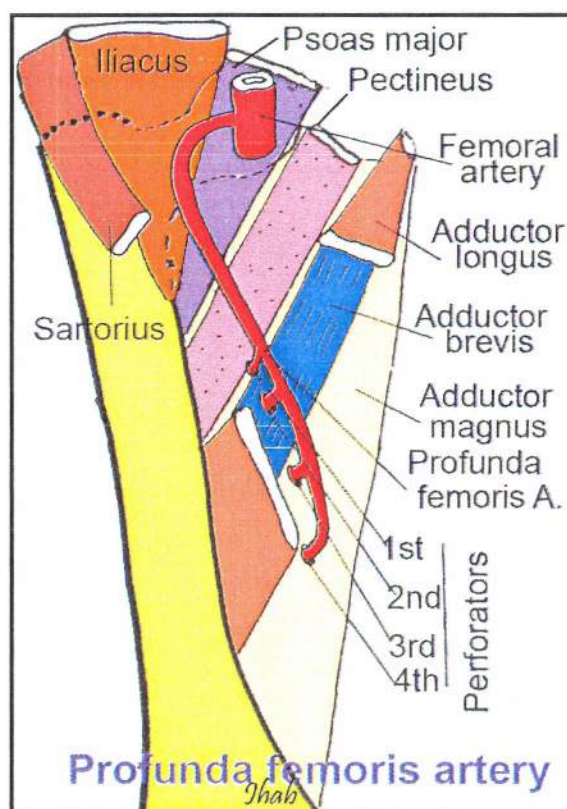
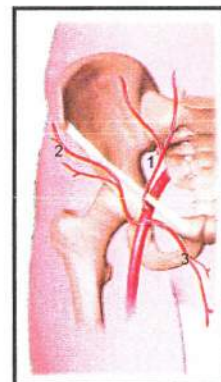
- 1<sup>st</sup> perforating: Arises above the adductor brevis, pierces the adductor magnus.
- 2<sup>nd</sup> perforating: Pierces adductor brevis and magnus.
- 3<sup>rd</sup> perforating: Arises below adductor brevis, pierces the adductor magnus.
- 4<sup>th</sup> perforating: Is the termination of profunda femoris A.

**Surface anatomy of femoral artery:**

Is represented by the upper  $\frac{2}{3}$  of a line drawn from midinguinal point (above) to adductor tubercle (below), when the hip is semiflexed, abducted & laterally rotated.

**Anastomoses of the femoral artery** "collaterals after its ligation":**A. Cruciate anastomosis:**

- **Transverse limb:** a. Transverse branch of lateral circumflex femoral (profunda).  
b. Transverse branch of medial circumflex femoral (profunda).





- **Vertical limb:** **Above:** - Ascending branch of medial circumflex femoral (profunda).  
 - Descending branches of inferior gluteal (internal iliac artery).  
**Below:** - Ascending branch of 1<sup>st</sup> perforator.

**B. Anastomosis at anterior superior iliac spine:**

- Superior gluteal artery (from internal iliac A.).
- Deep circumflex iliac (from external iliac A.).
- Superficial circumflex iliac (from femoral A.).
- Ascending branch of lateral circumflex femoral (from profunda femoris A.).

**C. Anastomosis at back of the thigh:**

Each perforator gives ascending, descending branches. They anastomose together forming a longitudinal chain which joins inf. gluteal A. (above) & popliteal A. (below).

**D. Anastomosis around greater trochanter.**

**E. Anastomosis around knee joint.**

**Great saphenous vein** (the longest vein in the body)

**It begins** on the dorsum of foot by union of medial end of the dorsal venous network (arch) & dorsal digital vein of the medial side of the big toe.

**Course & Relations:**

**In the foot:** It ascends in front of the medial malleolus behind the saphenous nerve.

**In the leg:** It ascends on the medial side of leg, behind medial condyles of tibia and femur (hand breadth behind medial border of the patella).

**In the thigh:**

- It ascends in the superficial fascia of the medial side to reach the saphenous opening.
- It traverses the cribriform fascia, pierces the femoral sheath to end in the femoral vein (4 cm below and lateral to the pubic tubercle).
- It has 10-20 valves (more numerous in the leg than the thigh).
- The valves divide the vein into segments to reduce the venous pressure on its wall.
- One of these valves is at termination of the vein into the femoral vein (sapheno-femoral valve).

**Tributaries:**

- 1) Superficial veins from foot, leg and thigh.
- 2) Communicating veins, connecting it with small saphenous vein.
- 3) Perforating veins pierce deep fascia to reach deep veins.
- 4) Superficial inguinal veins: Superficial circumflex iliac, external pudendal & epigastric veins.

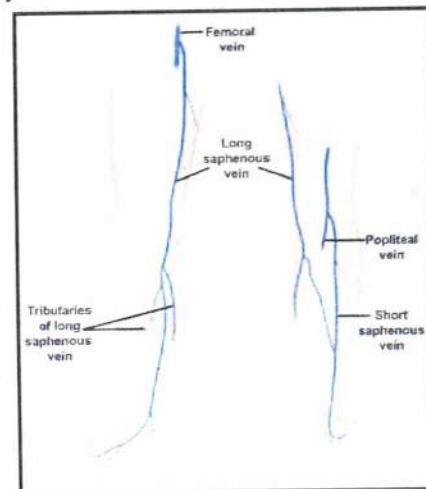
**Applied Anatomy:**

**1- Varicose veins:**

- **Cause:** Defect in valves of the perforating veins → reverse blood flow (from deep to superficial veins). It occurs on standing for long time as in soldiers or surgeons.
- **The veins become** tortuous, overstretched & dilated.
- **Complications:** - Rupture of the veins. - The blood inside stagnates, may thrombose.

**2- Coronary bypass:** A graft from a segment of the great saphenous vein is used to replace obstructed segment in the coronary artery. It is reversed to prevent flow obstruction by the valves.

**3- Venous cut down:** It has fixed position in front of medial malleolus; used in venous cut down.





# I- Muscles of Gluteal Region

## A) Superficial Layer (deltoid of lower limb)

### 1- Tensor fascia lata

**Origin:** Anterior 2 inches of the outer lip of the iliac crest.

**Insertion:** Anterior border of iliotibial tract which splits to enclose the muscle.

**N. Supply:** Superior gluteal N.

**Action:** 1- Weak abduction & medial rotation of the thigh.

2- Stretches the iliotibial tract to maintain the knee in full extension "during standing & walking".

### 2- Gluteus Maximus

**Origin:** - Outer surface of ilium, behind posterior gluteal line.

- Back of sacrotuberous ligament.

- Back of sacrum & coccyx.

**Insertion:** - Superficial  $\frac{3}{4}$  → Posterior border of iliotibial tract.

- Deep  $\frac{1}{4}$  → Gluteal tuberosity.

**N. Supply:** Inferior gluteal N.

**Action:** - Extends the flexed thigh, as rising from sitting position, running.

- Supports the pelvis on the femur.

- Lateral rotation & abduction of the hip.

- Tensor for iliotibial tract.

- Through iliotibial tract: it helps in extension of the knee.

- It is the main tensor of the fascia lata.

### Structures deep to the gluteus maximus:

- 2 Bony prominences: 1- Greater trochanter.

2- Ischial tuberosity.

- 2 Ligaments: 1- Sacrotuberous ligament.

2- Sacrospinous ligament.

- 3 Bursae: 1- On greater trochanter. 2- On ischial tuberosity.

3- On vastus lateralis.

- 3 Arteries: 1- Superior gluteal A. 2- Inferior gluteal A.

3- Internal pudendal A.

- 7 Nerves: - Above piriformis: Superior gluteal N.

- Below piriformis:

1- Inferior gluteal N.

2- Sciatic N.

3- N. to quadratus femoris.

4- Posterior cut. N. of thigh.

- From greater to lesser sciatic foramina:

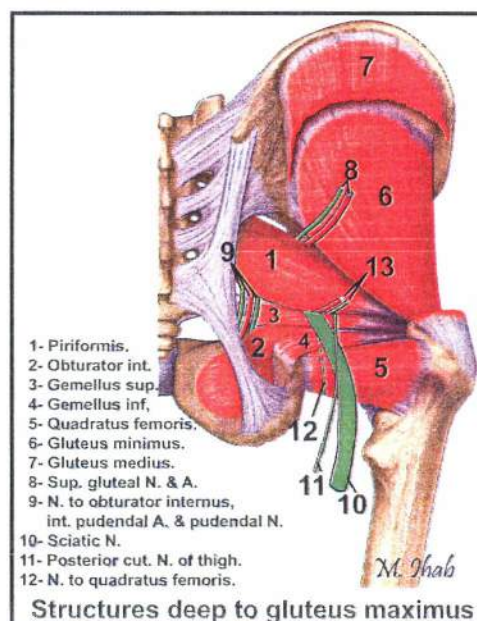
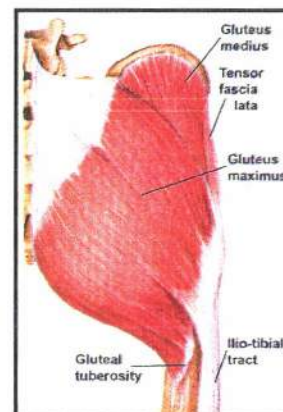
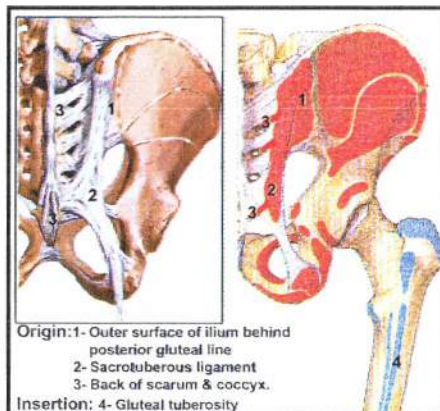
1- Pudendal N. 2- N. to obturator internus.

- 3 Groups of muscles:

1- Muscles of the gluteal region except gluteus minimus & tensor fascia lata.

2- Muscles attached to the ischial tuberosity.

3- Vastus lateralis.



Structures deep to gluteus maximus

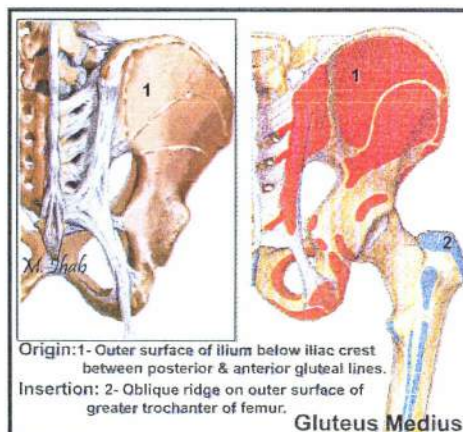
## B) Middle Layer

### 1- Gluteus Medius:

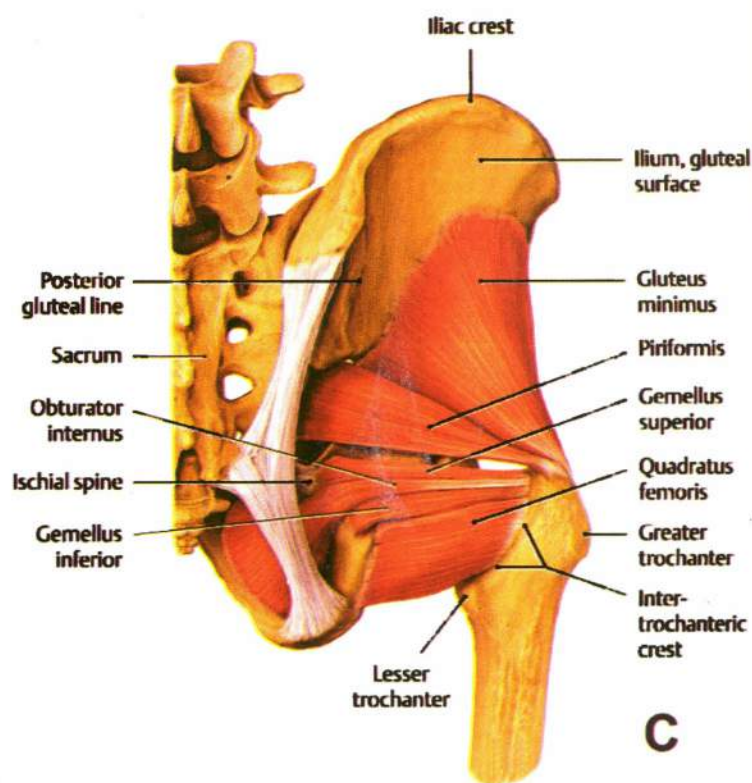
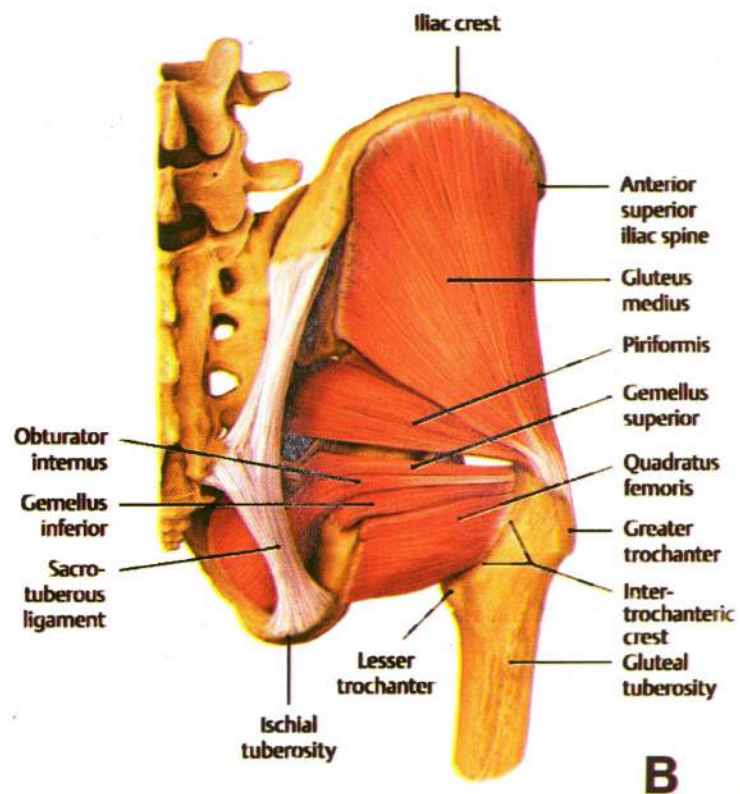
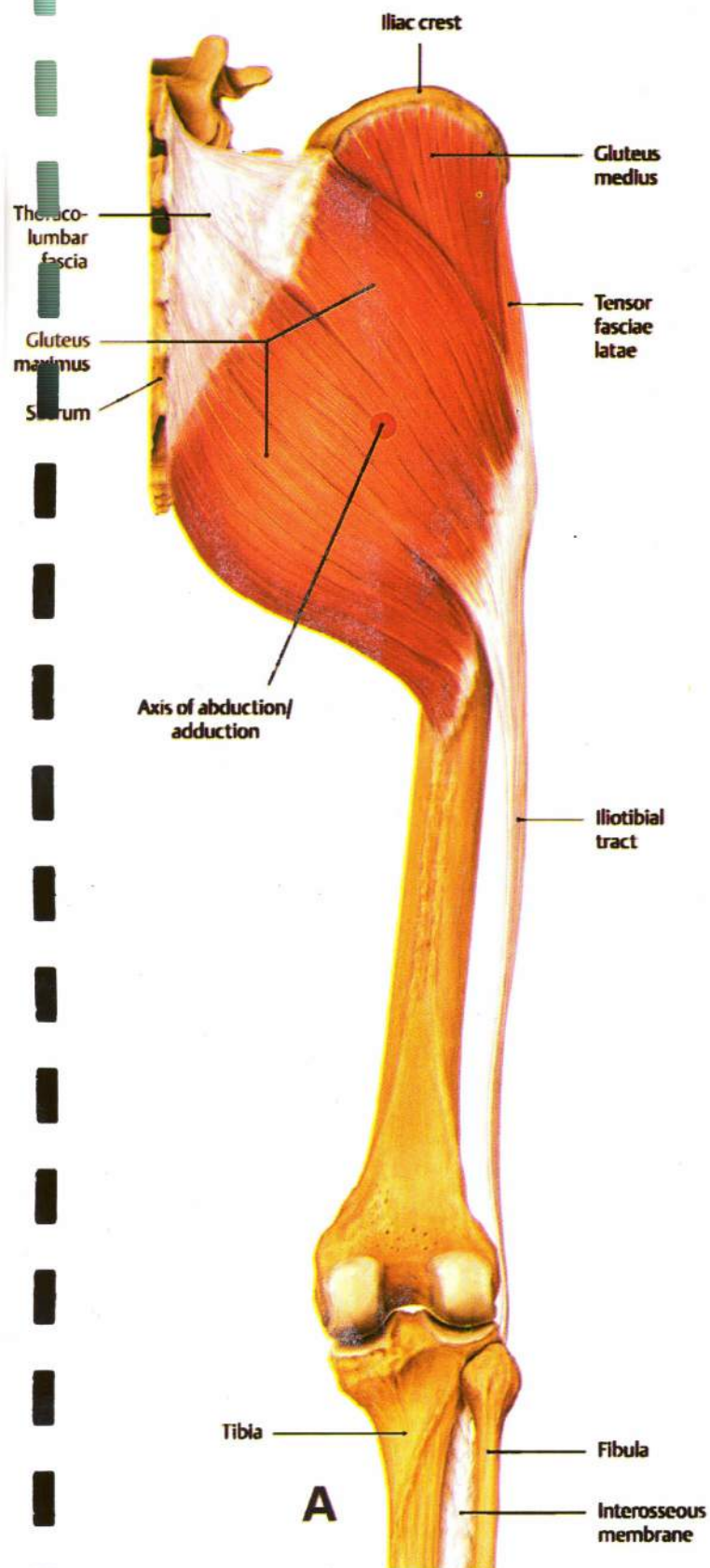
**Origin:** Outer surface of the ilium between iliac crest (above), posterior & middle gluteal lines.

**Insertion:** Oblique ridge on lateral surface of greater trochanter.

**N. Supply:** Superior gluteal N.

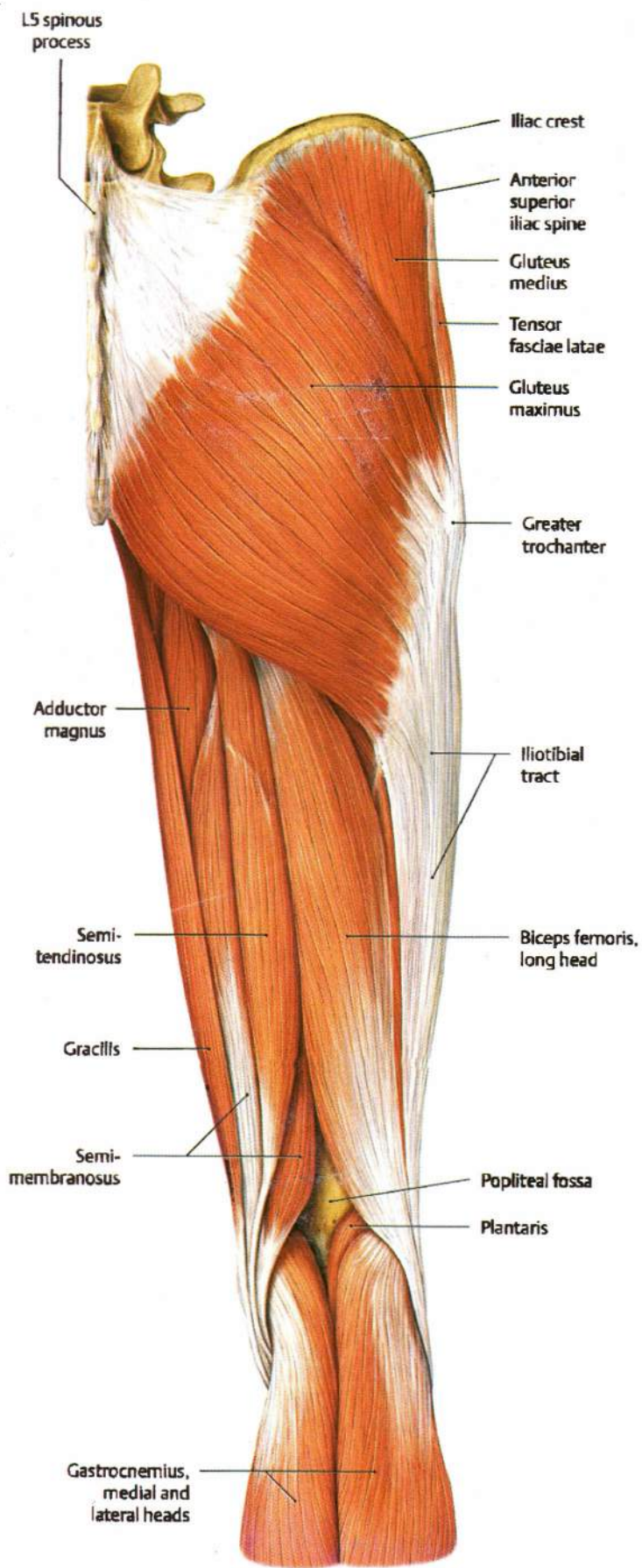




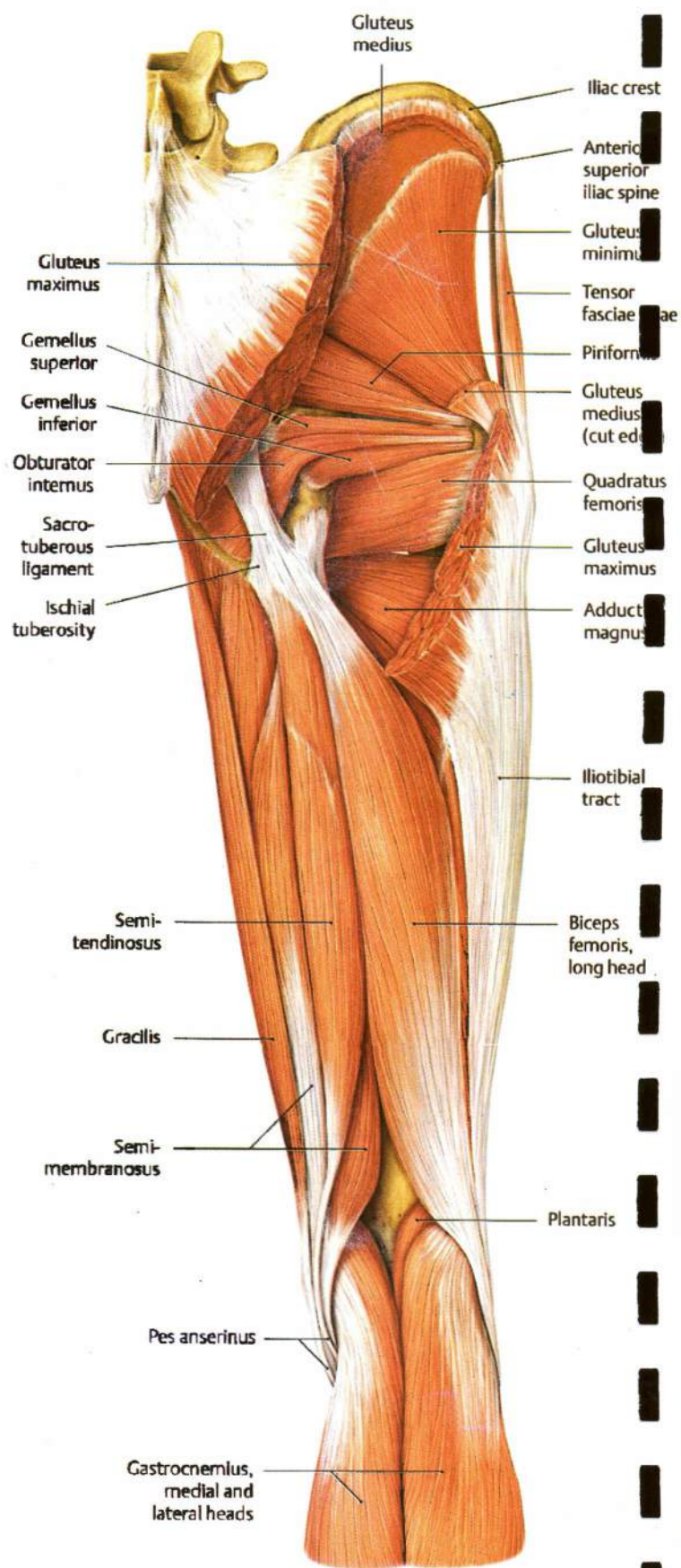


**Muscles of the Gluteal Region**





**A**  
**Muscles of back of the thigh & Gluteal region**



**B**



**Action:** 1- Abduction hip. 2- Medial rotation of the hip.  
3- Steadies the pelvis on the head of the femur on elevation of the other LL.

## 2- Piriformis:

**Origin:** Anterior surface of middle 3 pieces of the sacrum.

**Insertion:** Top of the greater trochanter.

**N. Supply:** Sacral plexus (S1 & 2) ± L5.

**Action:** - Lateral rotation of the hip.  
- Abduction of the flexed thigh.

## C) Deep Layer

### 1- Gluteus minimus:

**Origin:** Outer surface of the ilium between middle (anterior) & inferior gluteal lines.

**Insertion:** Front of greater trochanter.

**N. Supply:** Superior gluteal N.

**Action:** As gluteus medius.

- **The gluteus medius & minimus muscles** steady the pelvis on elevation of the other LL.
- Their bilateral paralysis → Waddling gait.
- Their unilateral paralysis → Lurching gait.

### 2- Obturator internus:

**Origin:** - Inner surface of obturator membrane.

- Margins of the obturator foramen.
- Area between obturator foramen & greater sciatic notch.

**Insertion:** Medial surface of the greater trochanter.

**N. Supply:** N. to obturator internus (L5 & S1, 2).

**Action:** Lateral rotation of the hip.

### 3- Gemellus superior:

**Origin:** Upper boundary of the lesser sciatic notch.

**Insertion:** - Medial surface of the greater trochanter.  
- Tendon of obturator internus.

**N. Supply:** N. to obturator internus (L5 & S1, 2).

**Action:** Lateral rotation of the hip.

### 4- Gemellus inferior:

**Origin:** Lower boundary of the lesser sciatic notch.

**Insertion:** - Medial surface of the greater trochanter.  
- Tendon of obturator internus.

**N. Supply:** N. to quadratus femoris (L4, 5 & S1).

**Action:** Lateral rotation of the hip.

### 5- Quadratus Femoris:

**Origin:** Outer aspect of the ischial tuberosity.

**Insertion:** Quadrate tubercle on trochanteric crest.

**N. Supply:** N. to quadratus femoris (L4, 5 & S1).

**Action:** Lateral rotation of the hip.

### The 6 lateral rotators of the hip are:

1- Piriformis.

2- Obturator internus.

3- Obturator externus.

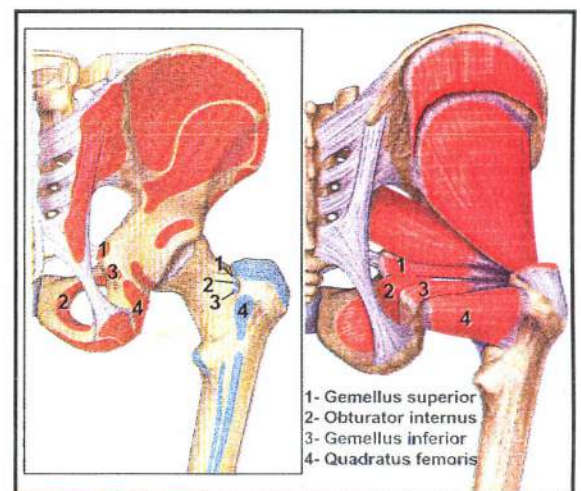
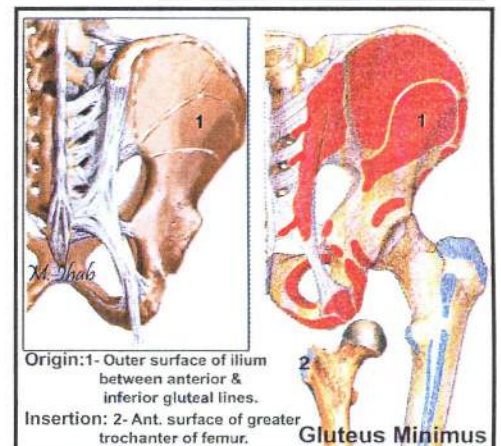
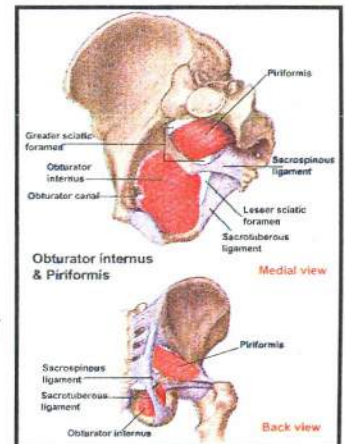
4- Gemellus superior.

5- Gemellus inferior.

6- Quadratus femoris.

**They:** a- Laterally rotate the hip.

b - Fix the head of the femur against acetabulum.





## II- Ligaments of the Gluteal Region

- 1- **Sacro-spinous ligament:** extends from ischial spine to last piece of sacrum & 1<sup>st</sup> piece of coccyx.
- 2- **Sacro-tuberous ligament:** It extends between from medial border of the ischial tuberosity to posterior iliac spines & lateral parts of the sacrum & coccyx.

### Function of the 2 ligaments:

- 1- They stabilize the sacrum, prevent its rotation at sacro-iliac joint by weight of the vertebral column.
- 2- They convert the greater & lesser sciatic notches into foramina.

## III- Foramina of the Gluteal Region

### Greater sciatic foramen:

- **Boundaries:** Greater sciatic notch, sacrotuberous & sacrospinous ligaments.

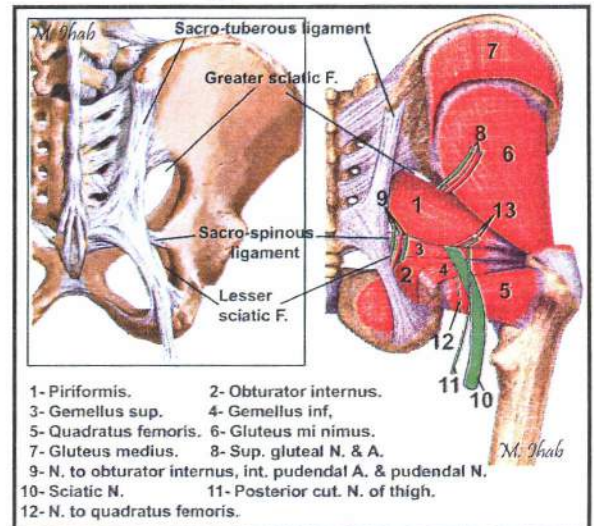
- **Structures pass through it:**

1- **Piriformis.**

2- **Above piriformis:** Sup. gluteal N. & vessels.

3- **Below piriformis:**

- 1- Inferior gluteal N. & vessels.
- 2- Sciatic N.
- 3- N. to quadratus femoris (deep to sciatic N.).
- 4- Posterior cutaneous N. of thigh.
- 5- 3 Structures from greater to lesser sciatic foramina:
  - Pudendal N. - Internal pudendal vessels. - N. to obturator internus.



### Lesser sciatic foramen:

- **Boundaries:** Lesser sciatic notch, sacrotuberous & sacrospinous ligaments.

- **Structures pass through it:** 1- Tendon of the obturator internus.

2- 3 Structures from greater to lesser sciatic foramina.

## IV- Nerves of the Gluteal Region

### (A) Sacral plexus

**Roots:** It is formed of:

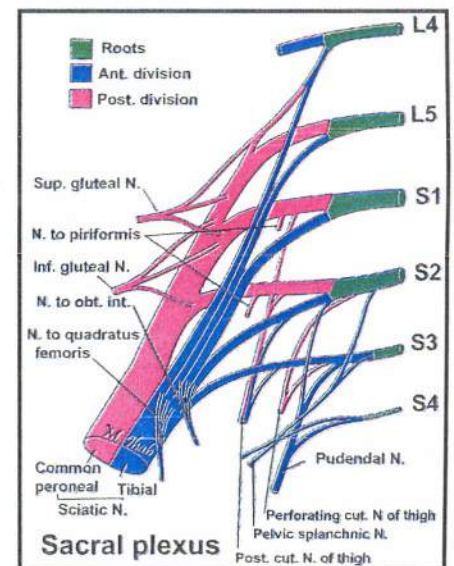
- Lumbosacral trunk (L4 & 5).
- Ventral rami of S 1, 2 & 3.
- Upper part of ventral ramus of S4.

N.B.: Upper part of ventral ramus of L4 shares in lumbar plexus & lower part of ventral ramus of S4 shares in coccygeal plexus, so the ventral rami of L4 & S4 are called nervous furcalis.

### Branches:

**Branches arise from sacral nerves only 'not lumbar':**

- 1- Nerve to piriformis (S1, 2).
- 2- 2- Perforating cutaneous N. of thigh (S2, 3).
- 3- Posterior cutaneous N. of thigh (S1, 2, 3).
- 4- Pelvic splanchnic N. (S2, 3, 4): parasympathetic.
- 5- Pudendal nerve (S2, 3, 4).
- 6- Perineal nerve (S4).





**Branches from the anterior division:**

- 1- Nerve to quadratus femoris (L4, 5 & S1).
- 2- Nerve to obturator internus (L 5 & S1, 2).
- 3- Tibial (medial popliteal) part of sciatic N. (L4, 5 & S1, 2, 3).

**Branches from the posterior division:**

- 1- Superior gluteal N. (L4, 5 & S1).
- 2- Inferior gluteal N. (L 5 & S1, 2).
- 3- Common peroneal (lateral popliteal) part of sciatic N. (L4, 5 & S1, 2 & 3).

**(B) Branches of the sacral plexus in the gluteal region****1- Superior gluteal nerve (post. division of L4, 5 & S1):**

- It supplies gluteus medius, minimus & tensor fasciae latae.

**2- Inferior gluteal nerve (posterior division of L5, S1 & 2):** supplies gluteus maximus only.**3- Pudendal N. (S2, 3 & 4).****4- N. to obturator internus (ant. division of L5, S1 & 2):** To obturator internus & gemellus superior.**5- N. to quadratus femoris (ant. division of L4, 5 & S1):** To quadratus femoris & gemellus inferior.**6- Posterior cutaneous N. of the thigh (S1, 2 & 3):**

- It enters the gluteal region through the greater sciatic foramen (below the piriformis).
- Branches: 1- Gluteal: to skin of the gluteal region. 2- Perineal: to the perineum.
- 3- Perforating branches: to skin on back of thigh, popliteal fossa & upper part of the leg.

**(C) Sciatic Nerve (The largest nerve in the body)**

**Root Value:** L4, 5 & S1, 2, 3.

**Origin:**

- It is the larger of the 2 terminal branches of the sacral plexus.
- It is formed of 2 components "tibial & common peroneal" that are enclosed within the same sheath.
- It is the thickest nerve in the body "1-2 cm thick".
- It is accompanied by companion A. (branch from inferior gluteal A.) "vasa nervosa".

**Course:**

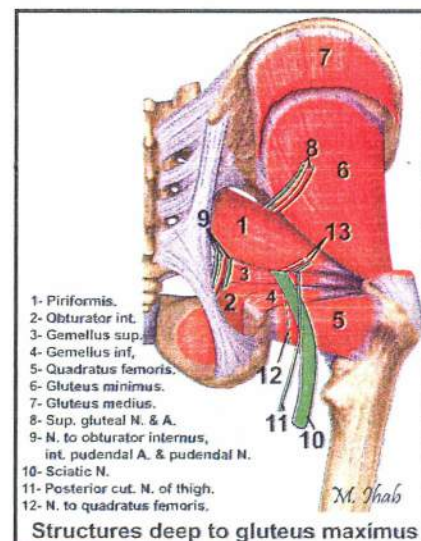
- It leaves the pelvis through the lower part of the greater sciatic foramen (below piriformis) to reach the gluteal region.
- It enters the back of the thigh midway between ischial tuberosity & greater trochanter.
- It ends at a variable point on back of the thigh "usually at lower  $\frac{1}{3}$ " by dividing into: medial popliteal (tibial) & lateral popliteal (common peroneal) nerves.
- NB: High division of sciatic nerve: Sometimes, the sciatic nerve divides in the pelvis.

**Relations:****A) At its exit from the pelvis:**

- **Posteriorly & above:** - Inferior gluteal N. & vessels.
- **Anteriorly:** - Nerve to quadratus femoris. - Body of the ischium.
- **Medially:** - Pudendal N., Internal pudendal A. & N. to obturator internus.

**B) In gluteal region & thigh:**

- **Posteriorly:** - Gluteus maximus.
- Posterior cutaneous nerve of the thigh.
- **Anteriorly:** - Gemellus superior.
- Obturator internus tendon.
- Gemellus inferior.
- Quadratus femoris.





**C) In the thigh:**

- **Posteriorly:** - Long head of biceps.
- **Anteriorly:** - Adductor magnus.
- **Laterally:** - Short head of biceps.
- **Medially:** - Semimembranosus & semitendinosus.

**Branches:**

- **Articular branches:** To back of the hip joint.
- **Muscular branches:** They arise at the level of the ischial tuberosity:
  - Laterally (from common peroneal part): To short head of biceps.
  - Medially (from tibial part): To:
    - 1- Semimembranosus. 2- Semitendinosus.
    - 3- Long head of biceps. 4- Ischial part of the adductor magnus.

**N.B.:** Intra muscular injection: is done by dividing the gluteal region into 4 quadrants, injection is carried in the upper outer quadrant (to avoid injury of sciatic N. or its branches) in gluteus medius.

**Surface anatomy:**

Is represented by a line (1 cm wide), between 3 points:

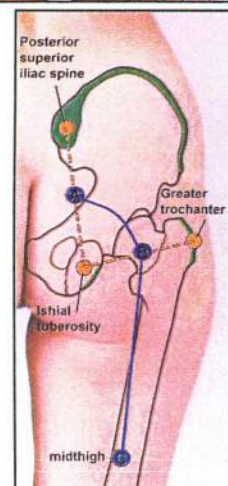
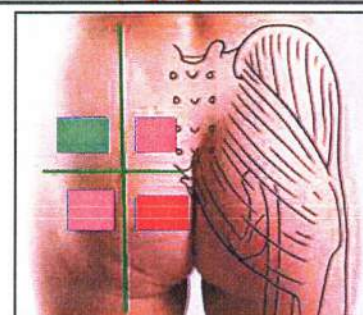
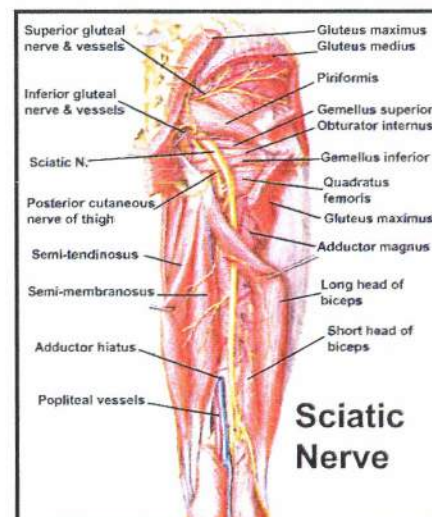
- **Point A:** midway between ischial tuberosity and posterior superior iliac spine.
- **Point B:** midway between ischial tuberosity & greater trochanter.
- **Point C:** at middle of the back of the thigh.

**Injury:**

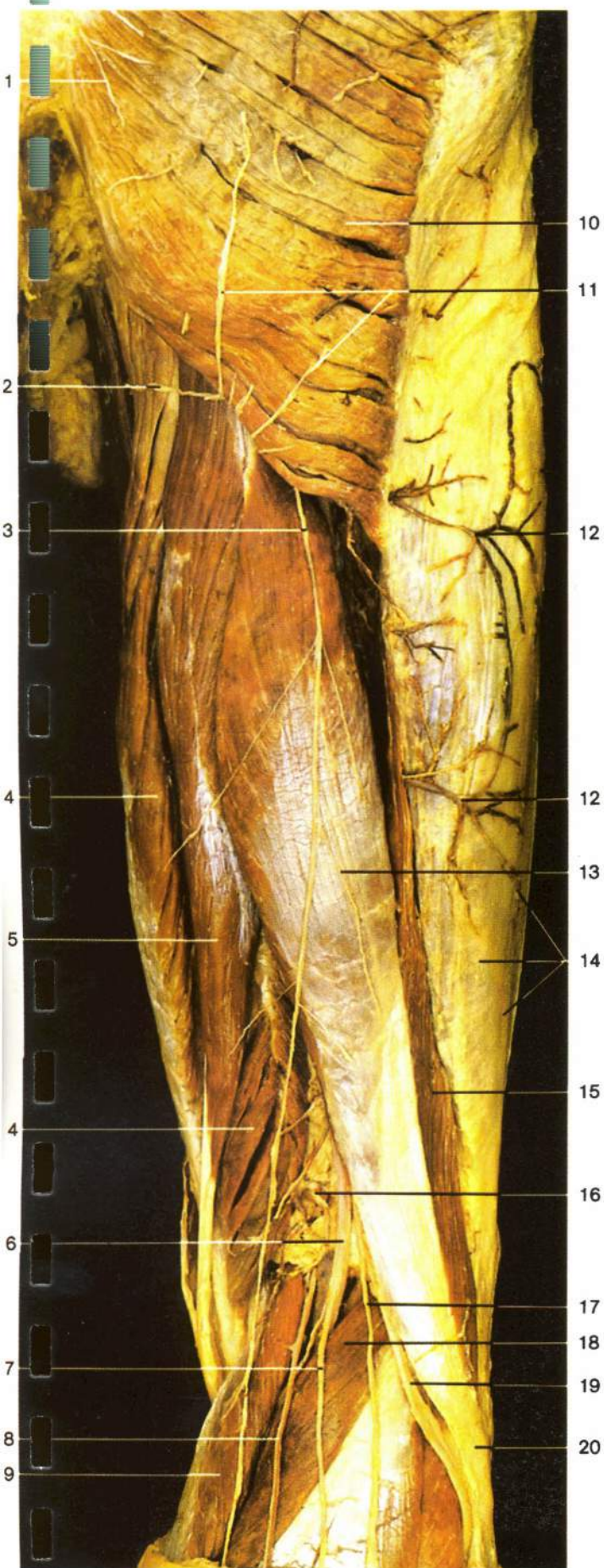
- **Causes:** 1- Posterior dislocation of the hip joint.  
2- Wrong intramuscular injection.  
3- Penetrating wound in the gluteal region.
- **Results:**
  - **Motor effects:** Paralysis of hamstrings & muscles of the leg and foot → foot drop & flail knee.
  - **Sensory loss below the knee joint except:** Medial side of the leg, foot (is supplied by saphenous nerve) & Back of thigh, calf (are supplied by posterior cutaneous N. of the thigh).

**Sciatica:**

- **It is** pain felt along the sensory distribution of the sciatic N.
- **It is caused by compression of the nerve by:**
  - 1- Inter vertebral disc prolapse.
  - 2- Intra-pelvic tumor.
  - 3- Inflammation of the nerve.







- 1 Middle cluneal nerves
- 2 Perineal branch of posterior femoral cutaneous nerve
- 3 **Posterior femoral cutaneous nerve**
- 4 Semimembranosus muscle
- 5 Semitendinosus muscle
- 6 **Tibial nerve**
- 7 Medial sural cutaneous nerve
- 8 **Small saphenous vein**
- 9 Medial head of gastrocnemius muscle
- 10 Gluteus maximus muscle
- 11 **Inferior cluneal nerve**
- 12 Cutaneous veins
- 13 Long head of biceps femoris muscle
- 14 Iliotibial tract
- 15 Short head of biceps femoris muscle
- 16 Popliteal fossa
- 17 Lateral sural cutaneous nerve
- 18 Lateral head of gastrocnemius muscle
- 19 **Common peroneal nerve**
- 20 Tendon of biceps femoris muscle
- 21 Inferior gluteal nerve
- 22 Sacrotuberous ligament
- 23 Inferior rectal branches of pudendal nerve
- 24 Anus
- 25 Gluteus medius muscle
- 26 Piriformis muscle
- 27 **Sciatic nerve**
- 28 Inferior gluteal artery
- 29 Gluteus maximus muscle (cut)
- 30 Quadratus femoris muscle
- 31 Sciatic nerve dividing into its two branches: the common peroneal nerve and the tibial nerve
- 32 Muscular branches of sciatic nerve to hamstring muscles
- 33 **Popliteal artery**
- 34 **Popliteal vein**
- 35 Small saphenous vein (cut)
- 36 Long head of biceps femoris muscle (cut)
- 37 **Superficial peroneal nerve**

**Cutaneous nerves of thigh (posterior aspect).**

The fascia lata and the fasciae of muscles have been removed.



## Popliteal fossa

**It is:** a diamond - shaped intramuscular space behind the knee joint & upper part of the leg.

### Boundaries:

- **Above & laterally:** - Biceps femoris.
- **Above & medially:** - Semimembranosus. - semitendinosus.
  - Gracilis & sartorius (on knee flexion).
- **Below & laterally:** - Lateral head of gastrocnemius.
  - Plantaris (if present).
- **Below & medially:** - Medial head of gastrocnemius.
- **Floor:** 1- Popliteal surface of femur.
  - 2- Back of knee joint and oblique popliteal ligament.
  - 3- Fascia covering popliteus.
- **Roof:** - Skin, Superficial fascia with:
  - \* Short saphenous V. \* Posterior cutaneous N. of thigh.
  - \* Deep (popliteal) fascia and pad of fat.

### Contents: (from deep to superficial):

- 1- Popliteal artery and its branches. It is the deepest structure.
- 2- Popliteal vein and its tributaries. It crosses the back of the artery from medial to lateral.
- 3- Tibial nerve: crosses back of the popliteal vessels from lateral to medial.
- 4- Common peroneal nerve: Descends laterally, along medial border of biceps.
- 5- Popliteal LNs (6-7) & fat, (one node is between the artery & femur).
- 6- End of small saphenous vein.

## Popliteal Artery

**It begins:** at the adductor hiatus as the continuation of the femoral A.

### Course:

- It descends from the upper medial boundary of the fossa to its inferior angle.
- Throughout its course, it lies in direct contact with the floor of the popliteal fossa so it is liable to injury in supracondylar fracture femur.

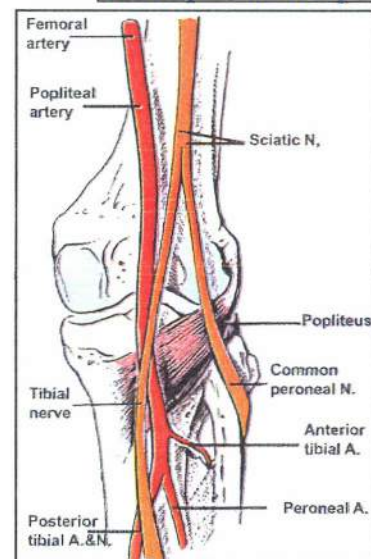
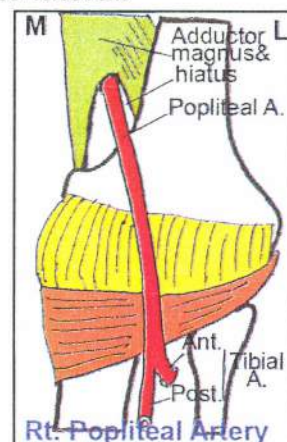
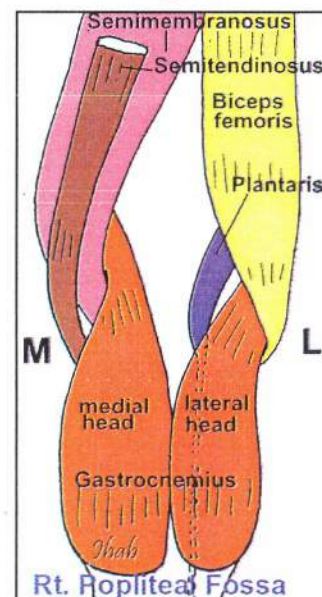
**It ends:** at lower border of the popliteus by dividing into anterior and posterior tibial arteries.

### Relations:

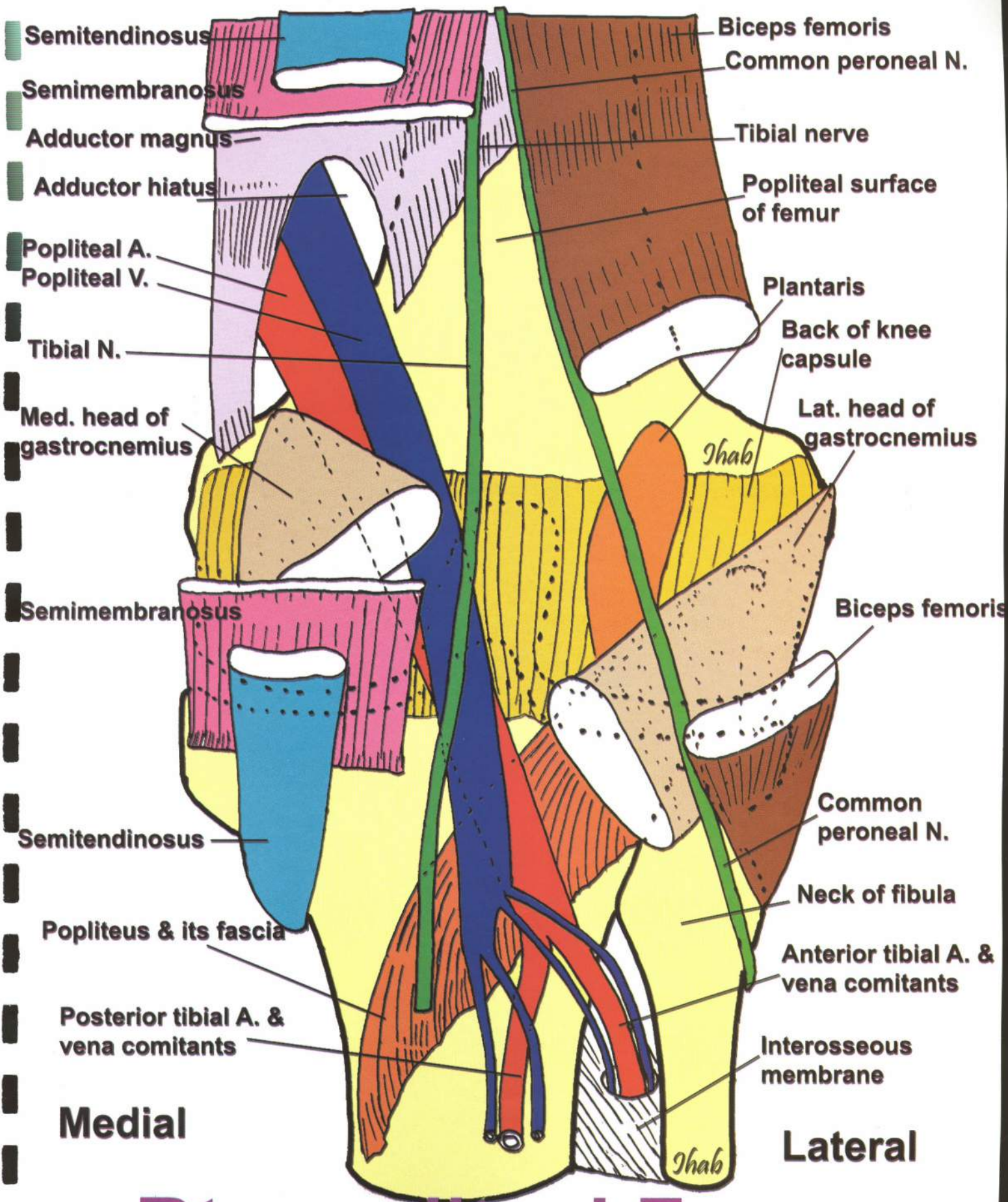
- **Anteriorly (deeply):**
  - 1- Popliteal surface of femur (with fat in between).
  - 2- Back of knee capsule & oblique popliteal ligament.
  - 3- Popliteus muscle & covering fascia.
- **Posteriorly (superficially):**
  - Semimembranosus (above). - Gastrocnemius & plantaris (below)
  - In middle of the popliteal fossa: It is crossed from lateral to medial by popliteal V. then the tibial N.

### Branches:

**A- Muscular branches** to nearby muscles & anastomoses with the 4<sup>th</sup> perforator.







# Rt. popliteal Fossa



**B- Articular (genicular) arteries:** to the knee joint.

- 1- Superior medial genicular: passes above medial femoral condyle.
- 2- Superior lateral genicular: passes above lateral femoral condyle.
- 3- Inferior medial genicular: passes below medial tibial condyle.
- 4- Inferior lateral genicular: passes below the lateral tibial condyle.
- 5- Middle genicular, pierces oblique popliteal lig. to supply cruciate ligaments & synovial membrane.

**C- Terminal branches:** Anterior & posterior tibial arteries.

**Surface anatomy of popliteal artery:** Is represented by a line drawn between 2 points:

- **Proximal point:** at junction of upper  $\frac{2}{3}$  and lower  $\frac{1}{3}$  of thigh,  $2\frac{1}{2}$  cm medial to its posterior midline.
- **Distal point:** is opposite tibial tuberosity on back of the knee joint.

**Anastomosis around the knee joint:** 10 arteries.

- Descending br. of lat. circumflex femoral A. "of profunda femoris A."
- Five genicular branches of the popliteal A.
- Circumflex fibular A. "from posterior tibial A."
- Descending genicular A. (arteria anastomotica magna) "of femoral A."
- Anterior & posterior tibial recurrent arteries "from anterior tibial A."

## Popliteal vein

**It begins** at lower border of the popliteus, by union of the venae comitantes of anterior & posterior tibial arteries.

**It ascends** on back of the popliteal A., crossing it from medial to lateral.

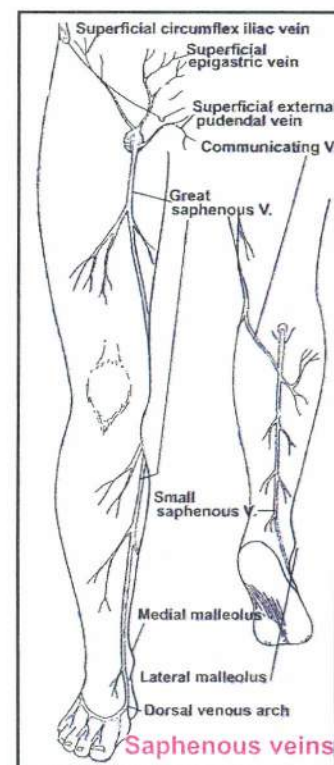
**It ends** at the adductor hiatus, by becoming the femoral vein.

**Tributaries:** 1- **Muscular veins.**

2- **Genicular veins** correspond to branches of the popliteal artery.

### 3- Small saphenous vein:

- It is formed at lateral end of the dorsal venous arch.
- It ascends below then behind the lateral malleolus.
- It ascends along middle of back of the leg accompanied by sural N.
- It ends in the popliteal vein, above the knee joint.



## Nerves in the Popliteal Fossa

	1- Tibial (medial popliteal) Nerve	2- Common peroneal (lat. popliteal N.)
<b>Root Value</b>	Ventral division of L4, 5 & S1, 2, 3.	Dorsal division of L4, 5 & S1, 2 ±3.
<b>Origin</b>	Larger of 2 terminal branches of sciatic N.	Smaller of 2 terminal branches of sciatic N.
<b>Course &amp; Relations</b>	<ul style="list-style-type: none"> <li>- It traverses popliteal fossa from upper to the lower angles.</li> <li>- It runs vertically.</li> <li>- It crosses the back of the popliteal vessels from lateral to medial.</li> <li>- The vein lies between the A. &amp; N.</li> </ul>	<ul style="list-style-type: none"> <li>- It traverses popliteal fossa from upper to lateral angles, along medial border of the biceps, superficial to lateral head of gastrocnemius &amp; plantaris.</li> <li>- It pierces posterior intermuscular septum. It winds around neck of the fibula (can be rolled here).</li> </ul>
<b>It ends</b>	At the lower border of popliteus by becoming the posterior tibial N.	In peroneus longus by dividing into superficial & deep peroneal nerves.



Branches	Muscular	Gastrocnemius (both heads), Popliteus, Plantaris & Soleus.	No branches.
	Articular (to knee joint)	1- Superior medial genicular. 2- Inferior medial genicular. 3- Middle genicular.	1- Superior lateral genicular. 2- Inferior lateral genicular. 3- Recurrent genicular.
	Cutaneous	<p><b>Sural N.</b></p> <ul style="list-style-type: none"> <li>- It descends between 2 heads of gastrocnemius.</li> <li>- It is joined by sural communicating N.</li> <li>- It passes behind then below the lateral malleolus with the small saphenous V.</li> <li>- It supplies:               <ol style="list-style-type: none"> <li>1. Posterolateral aspect of lower <math>\frac{1}{3}</math> of leg.</li> <li>2. Lat. side of the foot &amp; little toe.</li> </ol> </li> </ul>	<p><b>1. Sural Communicating N.</b></p> <p>It arises near the head of the fibula, crosses the lateral head of the gastrocnemius to join the sural N.</p> <p><b>2. Lateral cutaneous N. of calf</b></p> <p>It supplies the upper lateral aspect of the leg.</p>
Injury	Cause	Cut wound in the popliteal fossa.	(Commonest N. to be injured in L.L.) 1- Fracture neck of the fibula. 2- Tight plaster cast or trauma.
	Results	<p><b>Talipes calcaneo valgus</b></p> <ul style="list-style-type: none"> <li>- Paralysis of muscles of back of the leg &amp; sole of foot → Dorsiflexion, eversion of foot.</li> <li>- Sensory loss along sural &amp; plantar nerves distribution.</li> </ul>	<p><b>Talipes equino varus</b></p> <ul style="list-style-type: none"> <li>- Injury of deep peroneal N. → paralysis of muscles of anterior leg compartment → plantar flexion (foot drop).</li> <li>- Injury of superficial peroneal N. → paralysis of muscles of the lateral leg compartment → foot inversion.</li> <li>- Sensory loss on anterior &amp; Lat. aspects of lower part of the leg &amp; dorsum of foot.</li> </ul>

## I- Anterior Compartment of the leg

### A- Muscles

	Tibialis anterior (TA)	Ext. hallucis longus (EHL)	Ext. digitorum longus (EDL)	Peroneus tertius (PT)
Origin	Upper $\frac{1}{2}$ or $\frac{2}{3}$ of lateral surface of tibia. I.O. membrane.	- Middle $\frac{2}{4}$ of ant. surface of the fibula. I.O. membrane.	- Upper $\frac{3}{4}$ of the anterior surface of the fibula. - Interosseous membrane.	- Lower $\frac{1}{4}$ of anterior surface of the fibula. - I.O. membrane.
Course	Their tendons pass deep to superior & inferior extensor retinaculæ.			
			- It divides into 4 tendons → lateral 4 toes.	- It is absent in 4% of people.
Insertion	- Medial cuneiform bone. - Base of 1 <sup>st</sup> metatarsal bone.	Dorsal aspect of the base of distal phalanx of the big toe.	Base of the distal phalanges of the lateral 4 toe.	Dorsal aspect of the base of the 5 <sup>th</sup> metatarsal bone.
Nerve supply	Anterior tibial (deep peroneal) nerve. Rec. genicular N.			
Action	1- Dorsiflexion (extension) of the ankle. 2- Inversion of the foot "at subtalar & midtarsal joints". 3- Maintains med. arch of the foot.			
		2- Extension of all joints of the big toe.	2- Extension of all joints of the lateral 4 toes.	2- Eversion of the foot "subtalar & midtarsal joints". 3- Maintains lat. arch of the foot.



## B- Anterior Tibial (deep peroneal) Nerve

- **Origin:** - It is the smaller of the two terminal branches of common peroneal nerve.

- It begins in substance of the peroneus longus.

- **Course & relations:**

- It pierces anterior intermuscular septum to reach anterior compartment of the leg.

- The anterior tibial nerve starts lateral to the artery then anterior then lateral to it again.

- It enters dorsum of the foot.

- **It ends** by dividing into 2 terminal branches:

- a) Medial branch: supplies cleft between 1<sup>st</sup> & 2<sup>nd</sup> toes.
- b) Lateral branch: supplies Ext. digitorum brevis.

- **Branches:**

- **Muscular:**

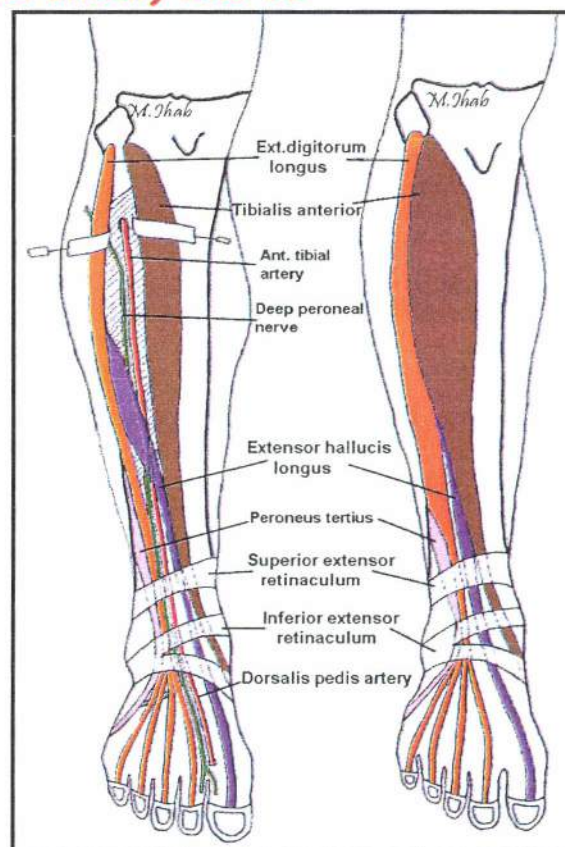
- The nerve itself supplies: TA, EDL, EHL & PT.
- Lateral branch supplies: Extensor digitorum brevis.

- **Cutaneous to:** Cleft between 1<sup>st</sup> and 2<sup>nd</sup> toes.

- **Articular to:** - Ankle joint (by deep peroneal nerve).  
- Tarsal and tarsometatarsal joints.

- **Surface Anatomy:** It is represented by a line from mid way between tibial tuberosity, neck of the fibula to midway between the 2 malleoli.

- **Injury:** leads to: - paralysis of muscles supplied by it (mention) → foot drop (talipes equinus).  
- Sensory loss in cleft between 1<sup>st</sup> and 2<sup>nd</sup> toes.



## C- Anterior Tibial Artery

- **Origin:** It is the smaller of 2 terminal branches of popliteal A., at lower border of popliteus.

- **Course:**

- It pierces the interosseous membrane to reach the anterior compartment of the leg.

- The anterior tibial nerve starts lateral to the artery then anterior then lateral to it again.

- In the lower 1/3 of the leg the artery lies in front of lower part of tibia.

- **It ends** in front of ankle joint (midway between the 2 malleoli) by becoming the dorsalis pedis A.

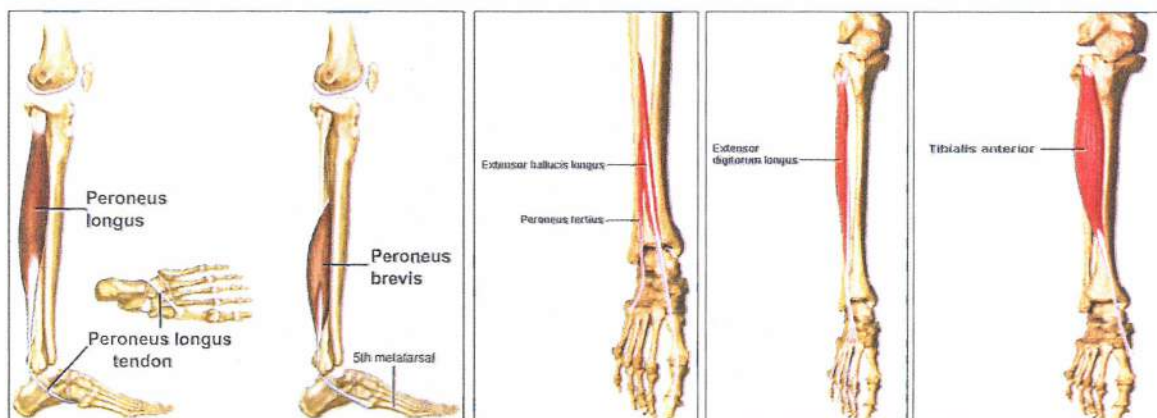
- **Relations:** As the anterior tibial nerve.

- **Branches:** 1-, 2- Anterior and posterior tibial recurrent: Share in anastomosis around the knee.

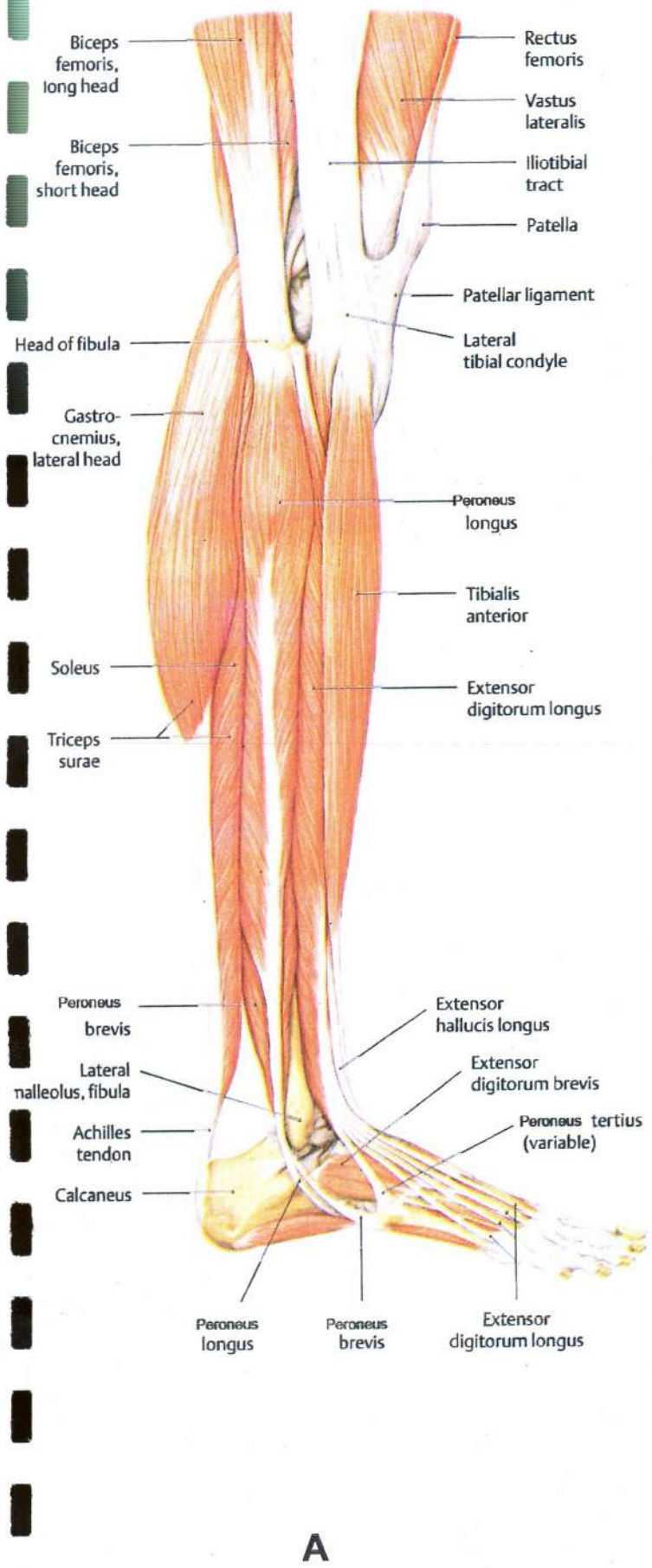
3- Muscular branches: Supply extensors of leg.

4-, 5- Anterior medial & lateral malleolar: Shares in anastomosis around the ankle.

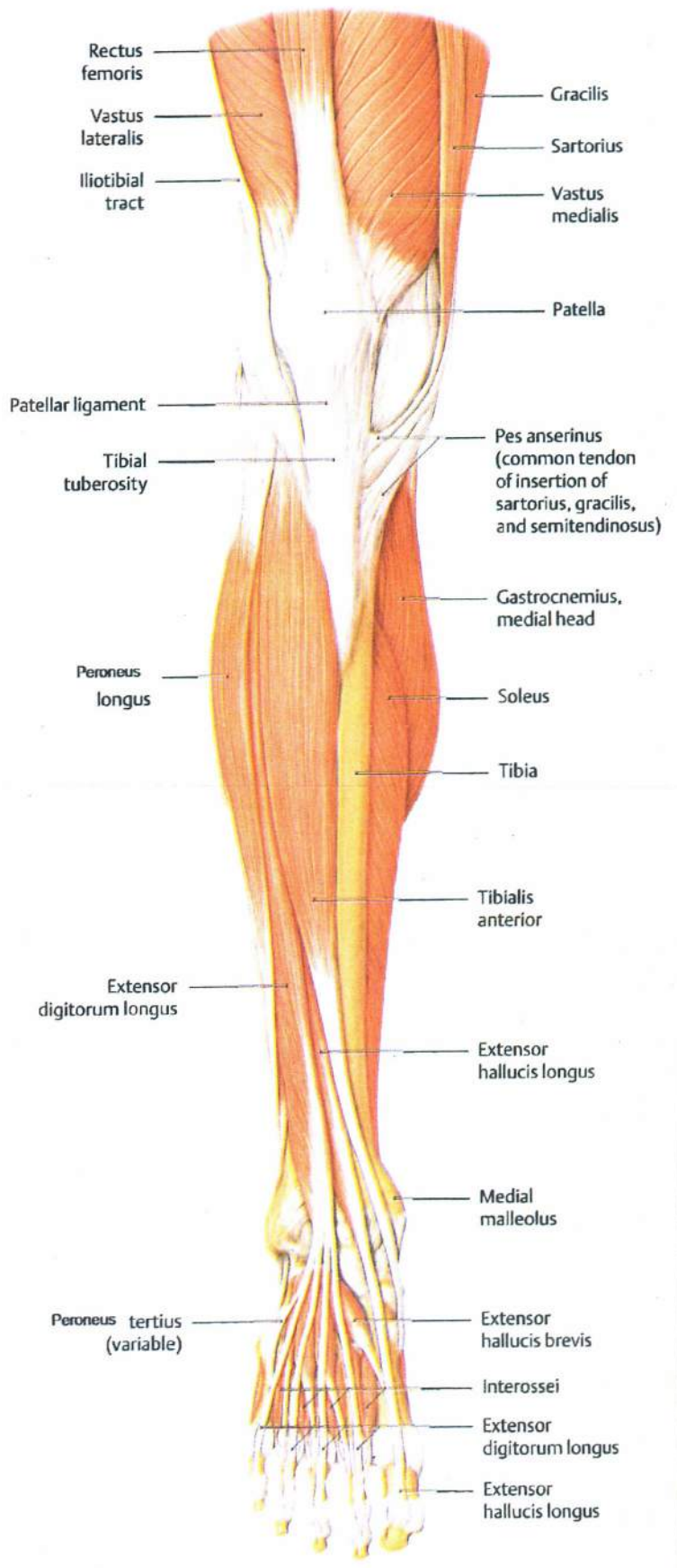
- **Surface Anatomy:** as the nerve.







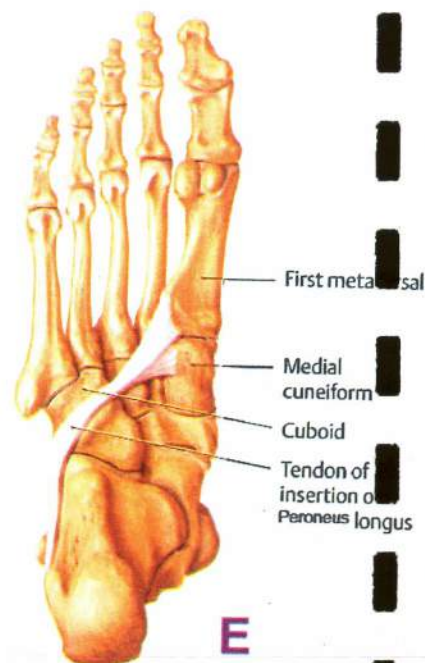
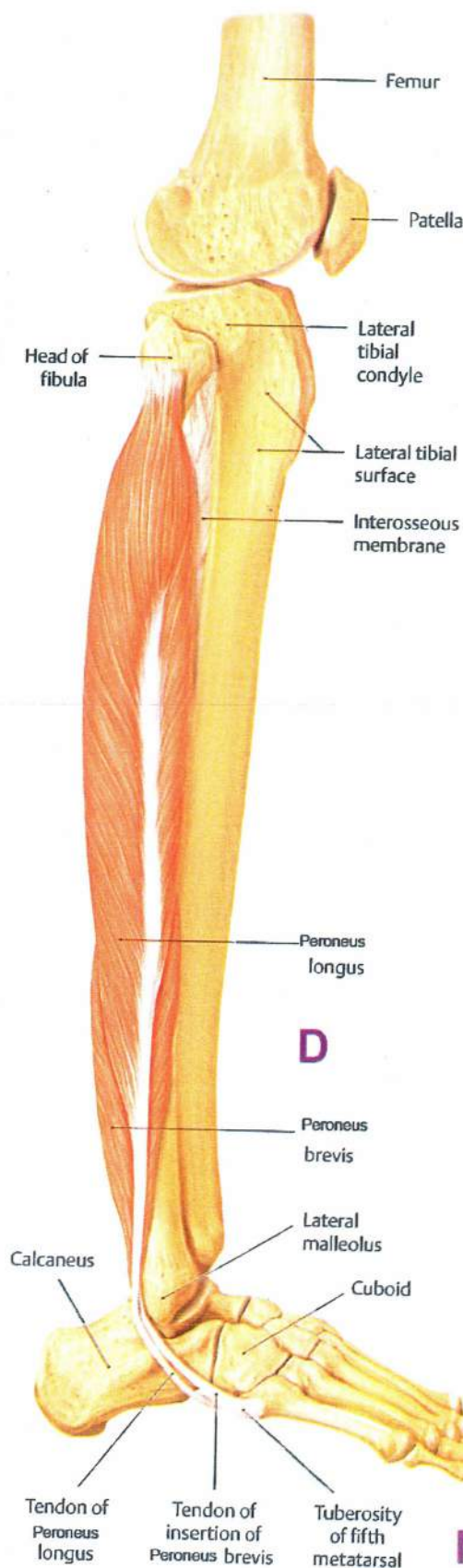
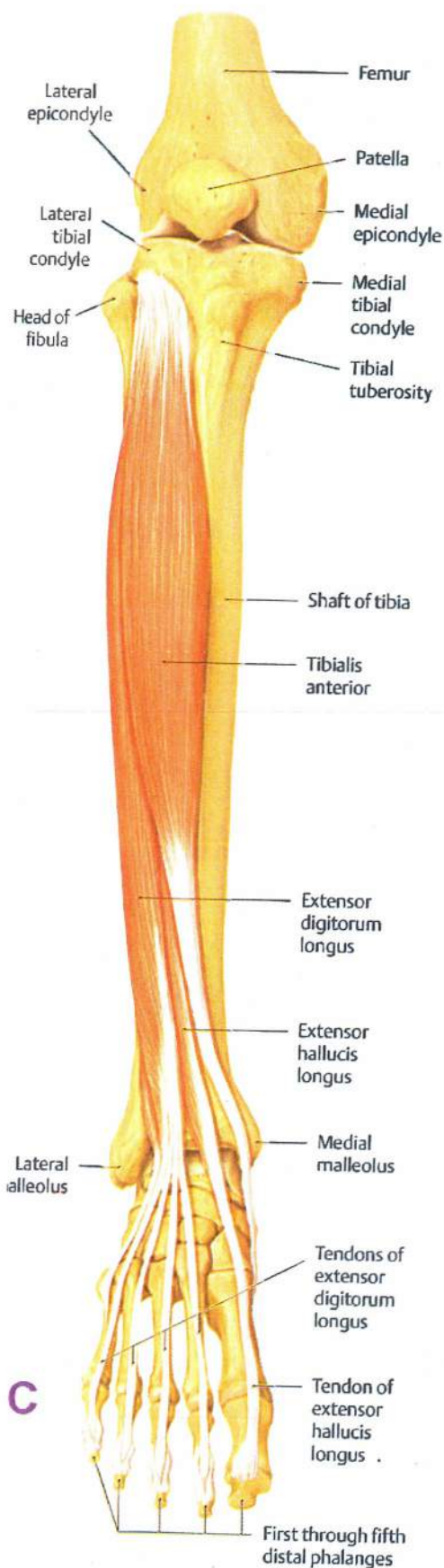
A



B

## Muscles of the Leg 1







## II- Lateral Compartment of the leg

### A- Muscles

	Peroneus longus	Peroneus brevis
<b>Origin</b>	- Upper $\frac{2}{3}$ of the lateral surface of the fibula. - Ant. & post. Intermuscular septa.	- Lower $\frac{2}{3}$ of lat. surface of the fibula. - Ant. & post. Intermuscular septa.
<b>Insertion</b>	Lateral aspect of: 1- Medial cuneiform bone. 2- Base of the 1 <sup>st</sup> metatarsal bone.	Tuberosity of the base of the 5 <sup>th</sup> metatarsal bone.
<b>N. Supply</b>	Musculocutaneous (superficial peroneal) nerve.	
<b>Action</b>	1- Plantar flexion (flexion) of the ankle. 2- Eversion of the foot. 3- Maintains the transverse & lateral longitudinal arches of the foot.	1- Plantar flexion (flexion) ankle. 2- Eversion of the foot. 3- Maintains the lateral longitudinal arch of the foot.

### B- Musculocutaneous (superficial peroneal) Nerve

- **Origin:** - It is one of the two terminal branches of common peroneal nerve.

- It begins lateral to neck of fibula (within peroneus longus).

- **Course & Relations:**

- It descends in the substance of peroneus longus, then between it & peroneus brevis.

- In the lower third of the leg it emerges between the 2 peronei, pierces the deep fascia.

- It ends by dividing into medial & lateral terminal branches.

- Each branch divides into 2 branches to become four.

- **Branches:** A) **Muscular** to: Peroneus longus & brevis.

B) **Cutaneous** to: - Lower  $\frac{1}{3}$  of lateral aspect of leg.

- Skin of dorsum of foot except:

o Cleft between 1<sup>st</sup> and 2<sup>nd</sup> toes "by deep peroneal N."

o Lateral border of the foot "is supplied by sural N."

o Medial border of the foot "is supplied by saphenous N."

- The medial terminal branch gives:

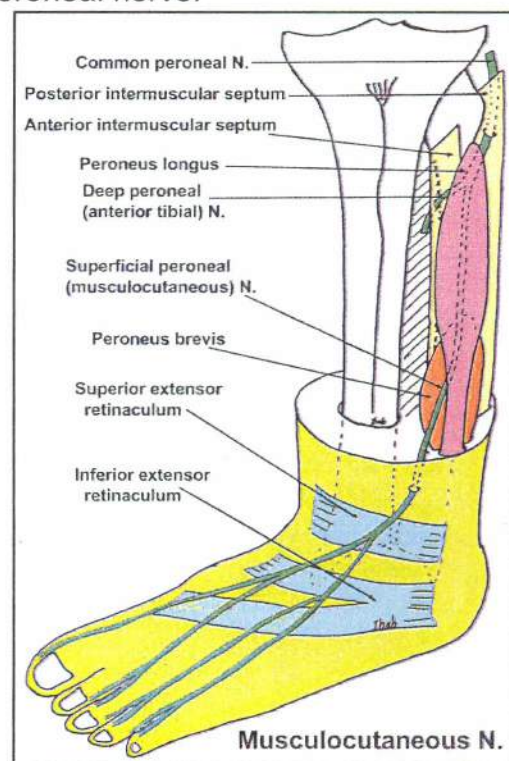
- Medial branch to medial side of the big toe.

- Lateral branch to cleft between 2<sup>nd</sup> & 3<sup>rd</sup> toes.

- The lateral terminal branch gives:

- Medial branch to cleft between 3<sup>rd</sup> & 4<sup>th</sup> toes.

- Lateral branch to cleft between 4<sup>th</sup> & 5<sup>th</sup> toes.



## III- Posterior Compartment of the leg

### A- Muscles 1- Superficial Group (Calf muscles)

	1- Gastrocnemius	2- Soleus	3- Plantaris
<b>Origin</b>	<b>Medial head:</b> From popliteal surface of femur above medial condyle <b>Lateral head:</b> From lateral surface of lateral condyle of femur. N.B.: - The lateral head contains a sesamoid bone (the fabella).	<b>Horse-shoe origin from:</b> - Back of upper $\frac{1}{3}$ of shaft & head of the fibula. - Soleal line and middle $\frac{1}{3}$ of medial border of tibia. - Fibrous arch between	Lower part of lateral supracondylar line of femur & oblique popliteal ligament. NB: It is rudimentary, may be absent.



	- It is a white muscle.	tibia and fibula. NB: It is multipennate & red, muscle.	
<b>Insertion</b>	The 2 bellies of the gastrocnemius end in a tendon which joins the soleus tendon forming tendocalcaneus (tendo Achilles). <b>Tendocalcaneus</b> is the thickest, strongest tendon in the body. It is inserted into the middle of the calcaneal tuberosity.		- In tendocalcaneus. Or - Posterior surface of the calcaneus.
<b>Nerve Supply</b>	Tibial nerve. A branch to each head.	- Superficial part (tibial N.). - Deep part (post. tibial N.).	Tibial nerve
<b>Action</b>	<b>The 2 heads of gastrocnemius &amp; soleus (triceps surae):</b> 1- Take the heel off the ground giving the limb a propulsive movement during walking. 2- Raising the body on tips of toes (ballet players). 3- Plantar flexion of the ankle & act as muscle pump. 4- The gastrocnemius is a flexor for the knee.		Weak flexion ankle & knee. Its tendon is used in autograft for fingers tendons.

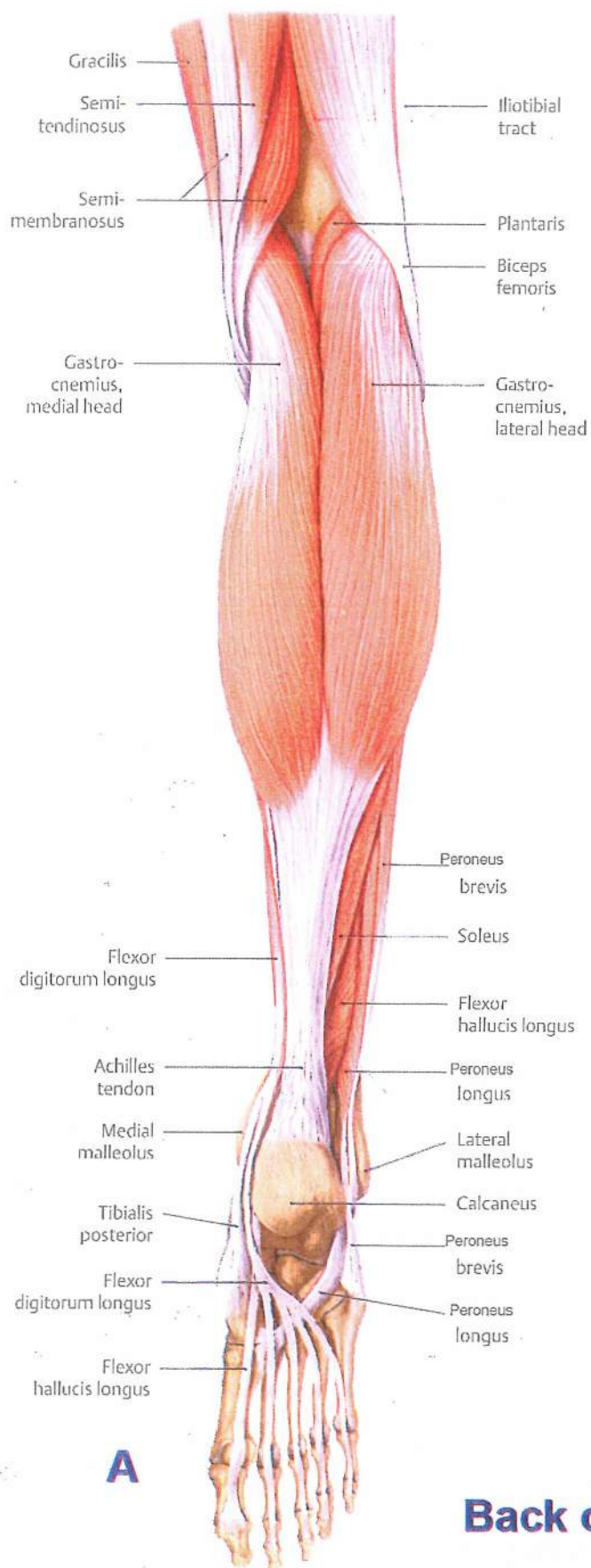
## 2- Deep Group

	1- Popliteus	2- Flexor hallucis longus (FHL)	3- Flexor Digitorum longus (FDL)	4- Tibialis posterior (TP)
<b>Origin</b>	- By a tendon from the anterior part of the groove below the lateral epicondyle of the femur. - Lateral meniscus. (It is intracapsular)	- Lower $\frac{2}{3}$ of back of fibula below origin of the soleus. - Back of interosseous membrane.	Back of tibia below the soleal line, medial to the vertical line.	- Back of tibia below the soleal line, lateral to the vertical line. - Back of the fibula. - Back of I.O.M.
<b>Insertion</b>	Back of tibia above the soleal line (flesh).	Base of terminal phalanx of big toe.	Base of terminal phalanges of lateral 4 toes.	- <b>Medial part to:</b> Navicular tuberosity. - <b>Lateral part to:</b> All tarsal bones except talus. 2 <sup>nd</sup> , 3 <sup>rd</sup> & 4 <sup>th</sup> metatarsal bones.
<b>N. Supply</b>	Tibial N.	Posterior tibial nerve		
<b>Action</b>	- Weak flexion of knee. - Unlocking of the knee at the beginning of flexion by either medial rotation of the tibia or by lateral rotation of the femur if the tibia is fixed.	- Flexion of all joints of the big toe. - Plantar flexion of the foot. - Supports the medial longitudinal arch.	- Flexion all joints of lateral 4 toes. - Plantar flexion of the foot. - Supports medial & lateral longitudinal archs.	- Plantar flexion of the foot. - Inversion of foot. - It supports medial longitudinal & transverse arches.

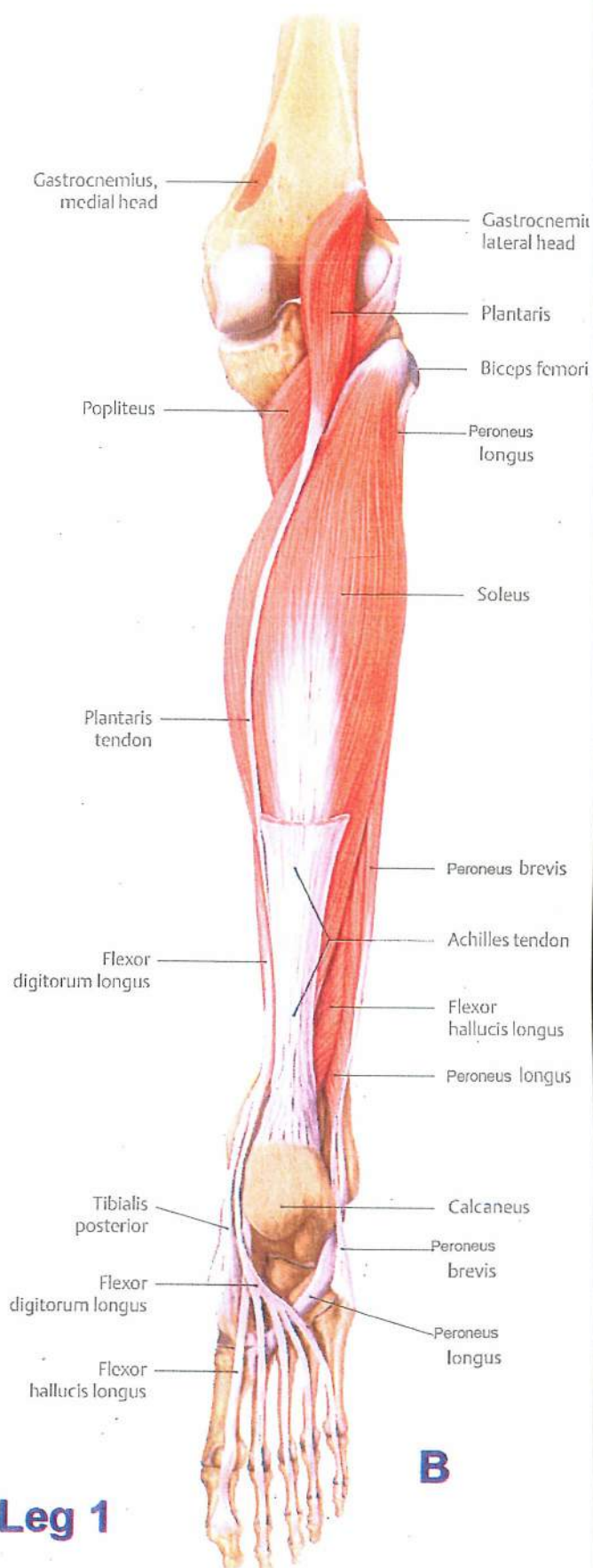
## B- Posterior Tibial Artery

- **It begins** at the lower border of popliteus as larger of the two terminal branches of popliteal A.
- **Course & End:**
  - It descends (with its venae comitantes) deep to the fibrous arch between the tibia & fibula.
  - It ends midway between medial malleolus & medial calcaneal tubercle "under cover of the flexor retinaculum" by dividing into medial & lateral plantar arteries.
  - The artery is crossed from medial to lateral by posterior tibial nerve.

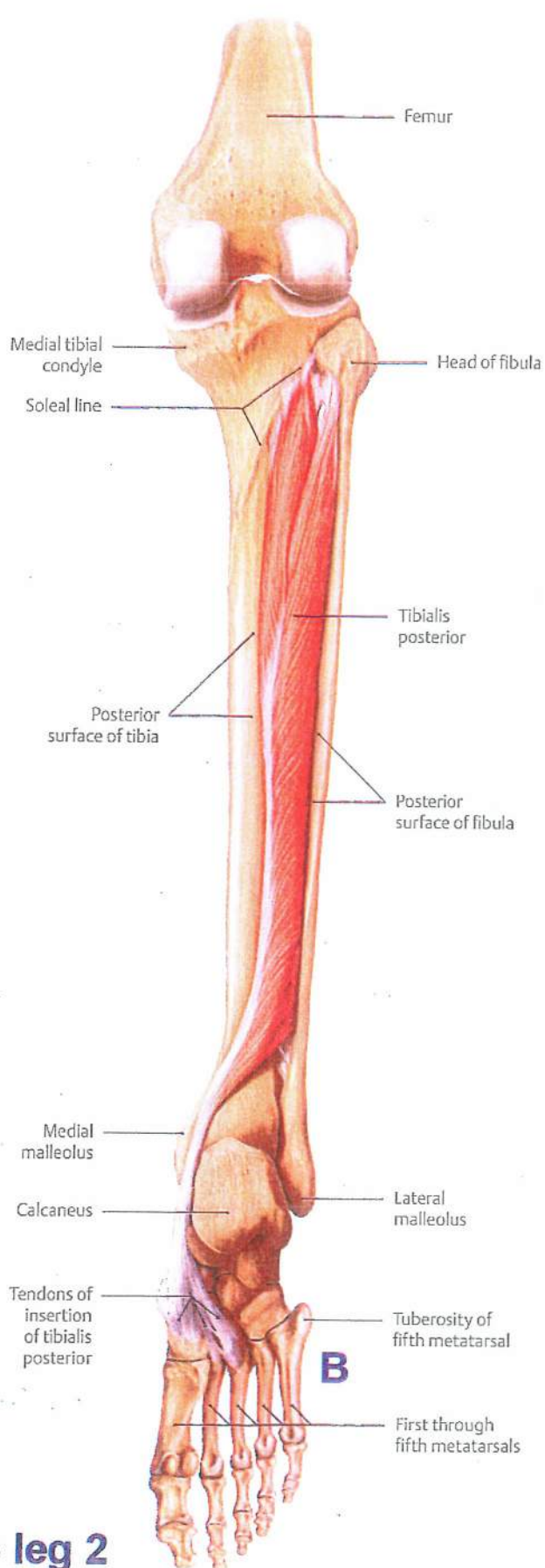
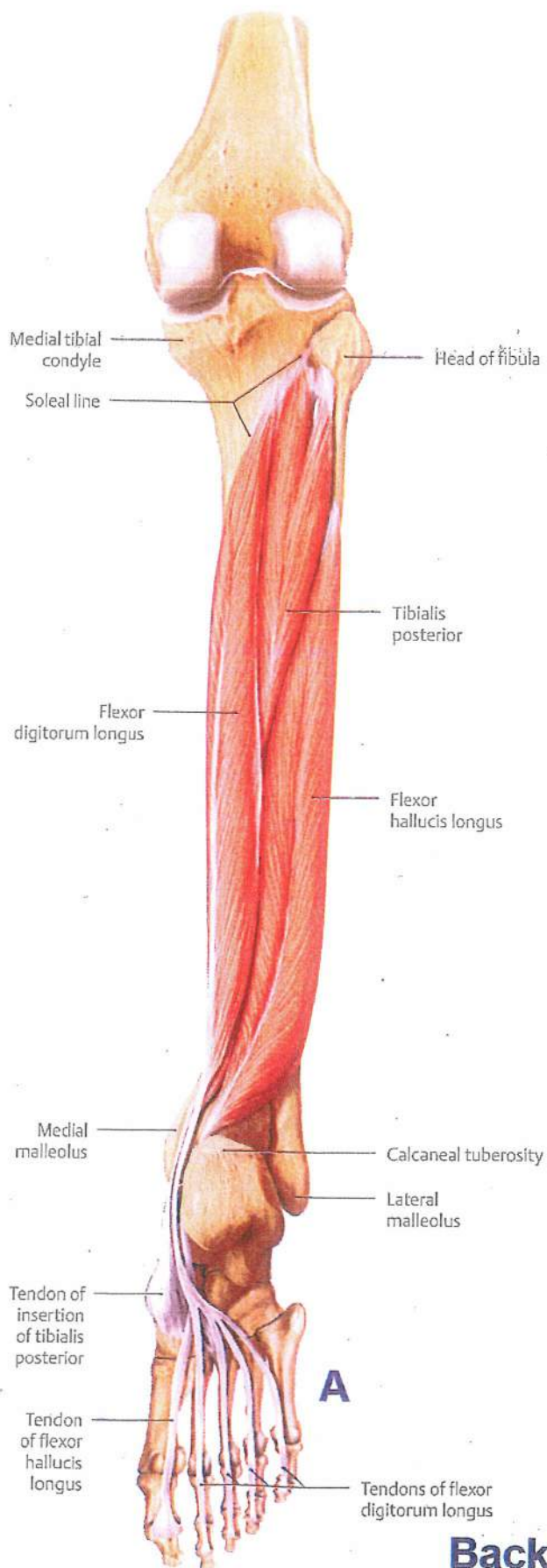




**Back of the Leg 1**





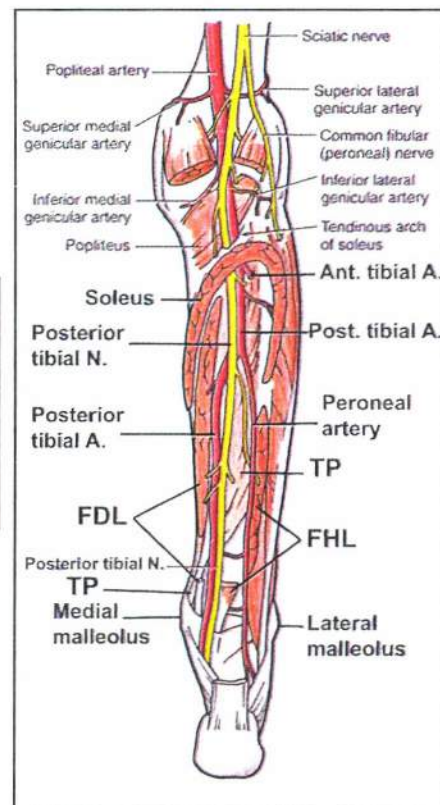
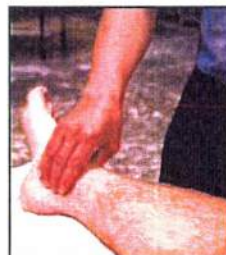


**Back of the leg 2**



**- Relations:**

- It passes downwards, medially between superficial, deep flexors.
- It descends on (deep or anterior to it successively):
  - 1- Tibialis posterior (between FDL & FHL).
  - 2- Flexor digitorum longus.
  - 3- Back of lower end of tibia (liable to injury on fracture tibia).
- The artery is covered by (superficial to it):
  - 1- Gastrocnemius and soleus.
  - 2- Skin & fascia, in lower  $\frac{1}{3}$  of leg (pulsations can be felt).
  - 3- Flexor retinaculum.
- The artery is crossed from medial to lateral by posterior tibial nerve.

**- Branches:**

**1- Circumflex fibular A.:** Winds around lat. aspect of neck of fibula to join the knee anastomosis.

**2- Peroneal A.:**

- It is the main artery to the leg. It arises  $2\frac{1}{2}$  cm distal to popliteus.
- It gives:
  - 1- Muscular branches: To nearby muscles.
  - 2- Nutrient: To fibula.
  - 3- Lateral calcaneal branch: on lateral side of calcaneus.
  - 4- Perforating branch: - Pierces the I.O.M. & may replace the dorsalis pedis A.
  - 5- Lateral malleolar ±.

**3- Nutrient A.:** To the tibia (the largest nutrient A. in the body).

**4- Muscular branches.**

**5- Communicating branch:** Joins the peroneal A.

**6- Medial calcaneal:** Pierces the flexor retinaculum, ends on medial side of the calcaneus.

**7- Medial malleolar:** Ends on the medial malleolus.

**8- Terminal branches:** Medial & lateral plantar arteries.

**- Surface Anatomy:** The artery is represented by a vertical line drawn between 2 points:

- Point A: In the midline of the back of the leg, opposite the tibial tuberosity (or head of fibula).
- Point B: Midway between medial malleolus & heel or medial calcaneal tubercle.

**- Anastomosis around the ankle:****A. Around medial malleolus:**

- |  |                                       |
|--|---------------------------------------|
| 1- Anterior medial malleolar of ant. tibial A.               | 2- Medial tarsal of dorsalis pedis A. |
| 3-, 4- Medial malleolar, medial calcaneal of post. tibial A. | 5- Branches of medial plantar A.      |

**B. Around the lateral malleolus:**

- |   |  |
|---|--|
| 1- Anterior lateral malleolar of ant. tibial A.               | 2- Lateral tarsal of dorsalis pedis A. |
| 3-, 4- Lateral calcaneal, perforating branches of peroneal A. | 5- Branches of lateral plantar A.      |

**C- Posterior Tibial Nerve (Tibial N. in the leg)**

- **It begins** at lower border of the popliteus as the continuation of tibial nerve, deep to the fibrous arch between the tibia & fibula.
- **It ends** midway between medial malleolus & medial calcaneal tubercle "under cover of the flexor retinaculum" by dividing into medial & lateral plantar nerves.
- It crosses the posterior tibial vessels from medial to lateral, between superficial & deep flexors.



**- Course & Relations:**

- It crosses the posterior tibial vessels from medial to lateral, between superficial & deep flexors.

- In upper 2/3 of the leg: The nerve is related:

- Superficially to: Soleus, gastrocnemius. - Deeply to: Tibialis posterior.

- Laterally to: Flexor hallucis longus. - Medially to: Flexor digitorum longus.

- In lower 1/3 of the leg: The nerve is related to the tibia (ant.) & skin, fascia (post.).

**- Branches:**

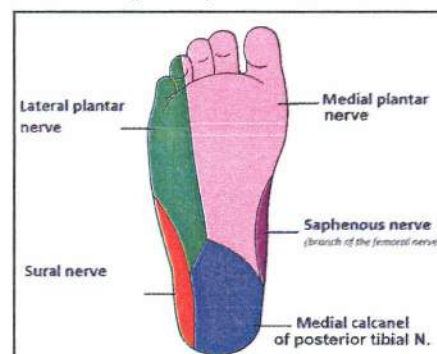
1- Muscular to: TP, FDL, FHL & soleus (enters its deep surface).

2- Cutaneous: medial calcaneal branch pierces the flexor retinaculum to supply skin of the heel.

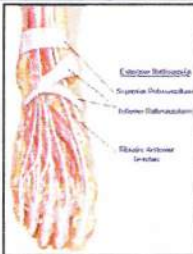
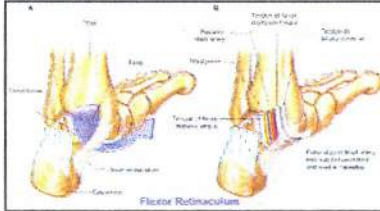
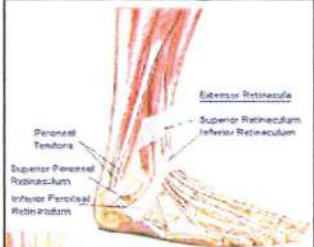
3- Articular: to ankle joint.

- Injury: Motor effect → paralysis of the muscles of back of the leg & sole → dorsiflexion & eversion.

Sensory loss: in skin of the sole of the foot.

**IV- Retinaculæ of the Ankle**

They are 5 retinaculæ (bands of deep fascia) surround the ankle joint; retain the tendons in place.

Retinaculum	Attachments	Structures deep to it	Superficial to it
<b>1- Superior extensor retinaculum</b>	<p>- It is 1 inch broad.</p> <p>- It extends from ant. border of the tibia to ant. border of the fibula.</p> 	<p>From medial to lateral:</p> <p>1- Tibialis ant. (Tom).</p> <p>2- EHL. (Has).</p> <p>3- Ant. tibial vessels. (Very).</p> <p>4- Deep peroneal N. (Nice).</p> <p>5- EDL. (Dogs) &amp;</p> <p>6- Peroneus tertius (Pigs).</p>	<p>- Beginning of the great saphenous vein.</p> <p>- Saphenous nerve.</p> <p>- Superficial peroneal N.</p>
<b>2- Inferior extensor retinaculum</b>	<p>It is Y-shaped, below the ankle.</p> <p>- The stem: Is attached to the ant. part of upper surface of the calcaneus.</p> <p>- Upper limb: To medial malleolus.</p> <p>- Lower limb: Blends to deep fascia of sole.</p>	As the superior one, but dorsalis pedis vessels replace the anterior tibial vessels.	
<b>3- Flexor retinaculum</b>	<p>Extends between the medial malleolus &amp; medial calcaneal tubercle.</p> 	<p>From medial to lateral:</p> <p>1- Tibialis post. (Tom).</p> <p>2- FDL. (Does).</p> <p>3- Post. tibial vessels. (Very).</p> <p>4- Post. tibial N. (Nice).</p> <p>5- FHL. (Hats).</p>	
<b>4- Superior peroneal retinaculum</b>	Extends from back of the lat. malleolus to lateral surface of the calcaneus.	<p>- Peroneus longus.</p> <p>- Peroneus brevis.</p> 	<p>- Sural N.</p> <p>- Short saphenous vein.</p>
<b>5- Inferior peroneal retinaculum</b>	Extends from upper to lower parts of the lateral surface of the calcaneus. It is in line with the stem of the inferior extensor retinaculum.		

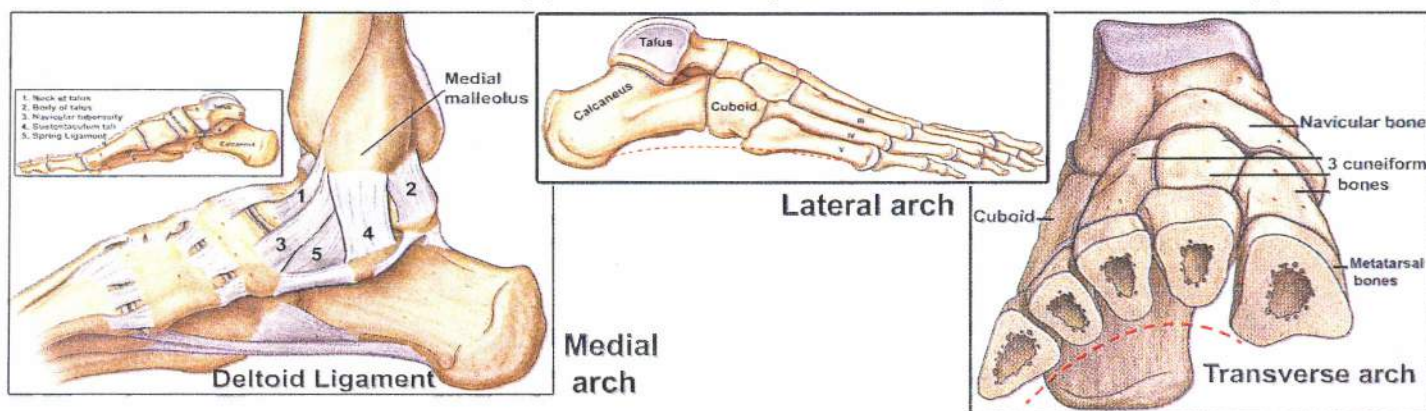


## I- Arches of the foot

Tarsal, metatarsal bones are arranged in a way to give an arched form to the skeleton of the foot.

Arch	Bones forming it		Factors maintaining it
<b>1. Medial longitudinal arch.</b>	<b>9 bones:</b> - Calcaneus. - Talus. - Navicular - 3 cuneiforms - Medial 3 metatarsals	- Its apex is at the head of the talus. - It is higher than the lateral one. - It helps in elastic propulsion during walking (kinetic arch).	<b>Bony factors:</b> Shape of the bones forming it. <b>Ligamentous factors:</b> - Plantar aponeurosis. - Spring ligament. - Interosseous ligaments. - Deltoid ligament. <b>Muscular factors:</b> 1- FDL of 2 <sup>nd</sup> & 3 <sup>rd</sup> toes. 2- Flexor hallucis longus. 3- Tibialis ant. & post. 4- Short muscles of big toe.
<b>2. Lateral longitudinal arch.</b>	<b>4 bones:</b> - Calcaneus. - Cuboid - Lateral 2 metatarsals	It supports the body weight in standing position (static arch).	<b>Bony factors:</b> Shape of the bones forming it. <b>Ligamentous factors:</b> - Plantar aponeurosis - Short & long plantar ligaments. <b>Muscular factors:</b> 1- Peroneus longus, brevis & tertius. 2- Tendons of flexor digitorum longus to 4 <sup>th</sup> and 5 <sup>th</sup> toes. 3- Short muscles of the little toe.
<b>3. Transverse arch.</b>	- Cuboid & 3 cuneiform bones. - Bases of all metatarsal bones.		<b>Bony factors:</b> Shape of lateral & middle cuneiforms. <b>Ligamentous factors:</b> Interosseous ligaments. <b>Muscular factors:</b> 1- Tendon of peroneus longus & tibialis posterior. 2- Transverse head of add. hallucis. 3- Dorsal interossei.

In infants, these arches are normally present, but they are masked by fat. So the foot appears flat.



### - Functions of the arches:

- 1- Give resilience to the foot.
- 2- Propelling in walking, running.
- 3- Support body weight in standing; distribute the weight to foot bones.
- 4- Shock absorbing factor on falling on the ground.
- 5- Protect the plantar nerves & vessels.

- **Flat foot:** may occur due to weak muscles → yielding of foot arches.

## II- Dorsalis pedis artery

- **It begins** in front of the ankle, midway between the 2 malleoli as continuation of the ant. tibial A.



- **Course:** It runs on the dorsum of the foot, in 1<sup>st</sup> interosseous space.
- **It ends** by passing between the 2 heads of 1<sup>st</sup> dorsal interosseous muscle to reach the sole and anastomoses with the end of the plantar arch.

- **Relations:**

- **Superficially:** 1. Skin and fasciae (pulsations can be felt).  
2. Inferior extensor retinaculum.  
3. Extensor hallucis brevis, near its end.

- **Deep to it:** Talus, navicular and intermediate cuneiform

- **Laterally:** - Medial division of anterior tibial nerve.

- Tendon of extensor digitorum longus.

- **Medially:** Extensor hallucis longus tendon.

- **Branches:**

1. & 2. **Lateral & medial tarsal A.:** share in anastomosis around ankle.

3. **Arcuate artery**

- It curves laterally opposite the bases of metatarsal bones.
- It gives 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> dorsal metatarsal arteries.
- Each dorsal metatarsal artery will divide into 2 dorsal digital branches to clefts between the toes. The 4<sup>th</sup> supplies the lateral side of little toes as well.

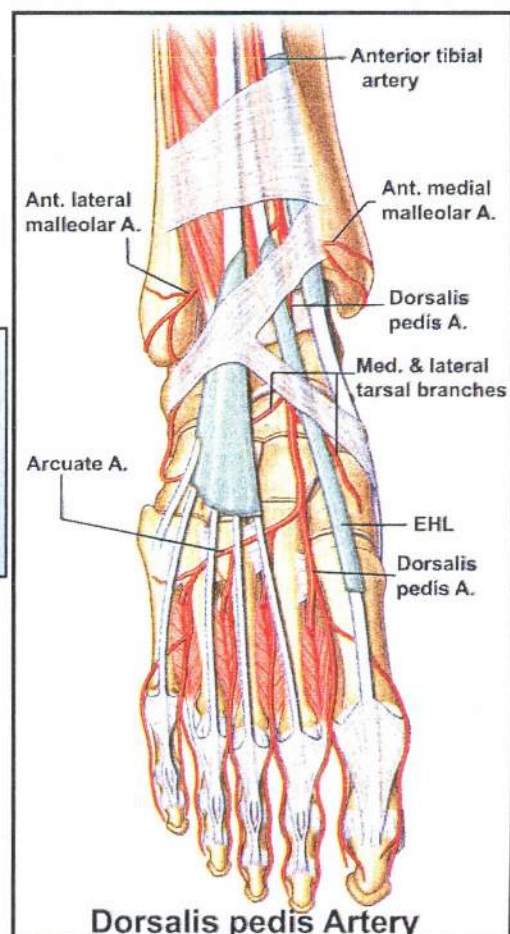
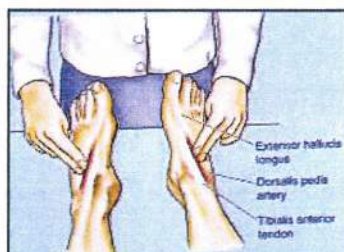
4. **1<sup>st</sup> dorsal metatarsal artery:** supplies dorsal aspect of the cleft between 1<sup>st</sup> & 2<sup>nd</sup> toes.

5. **1<sup>st</sup> plantar metatarsal artery:** It arises in the sole; it supplies plantar aspect of the cleft between 1<sup>st</sup> & 2<sup>nd</sup> toes.

- **Surface anatomy:** Is represented by a line drawn between:

\*Point 1: In front of ankle midway between the 2 malleoli.

\*Point 2: At proximal end of 1<sup>st</sup> metatarsal space.



### III- The sole of the foot

#### Muscles of the sole

1 <sup>st</sup> Layer	3 Muscles	1- Abductor hallucis. 2- Flexor digitorum brevis. 3- Abductor digiti minimi.
2 <sup>nd</sup> Layer	2 Tendons,	1- Flexor digitorum longus. 2- Flexor hallucis longus.
	5 Muscles	- 4 Lumbricals. - Flexor accessories.
3 <sup>rd</sup> Layer	3 Muscles	1- Flexor hallucis brevis. 2- Flexor digiti minimi brevis. 3- Adductor hallucis.
4 <sup>th</sup> Layer	2 Tendons,	1- Peroneus longus. 2- Tibialis posterior.
	7 Muscles	3 plantar & 4 dorsal interossei.

#### Plantar nerves

They start midway between medial tubercle of the calcaneus & medial malleolus.

##### 1. Medial plantar nerve

- **It arises** deep to the flexor retinaculum as the larger of the 2 terminal branches of posterior tibial N.



- **It runs forwards** between abductor hallucis and flexor digitorum brevis supplying both muscles.
- **It ends** at the base of the 1<sup>st</sup> metatarsal bone by dividing into 3 plantar digital nerves.
- **Branches:** It corresponds to median N. in the hand, supplies:
  - **Muscular to:** Abductor hallucis, Flexor hallucis brevis, Flexor digitorum brevis and 1<sup>st</sup> lumbrical.
  - **Cutaneous:** 1. Medial  $\frac{2}{3}$  of the sole, from cutaneous branches that pierce the plantar aponeurosis.  
2. Medial 3½ toes.

## 2. Lateral plantar nerve

- **It arises** deep to flexor retinaculum as the smaller of the 2 terminal branches of posterior tibial N.
- **It runs** forwards and laterally medial to lateral plantar A. (between 1<sup>st</sup> & 2<sup>nd</sup> layers of the sole) towards the base of 5<sup>th</sup> metatarsal bone.
- **It divides into:**

**Superficial division:** passes forwards between 1<sup>st</sup> & 2<sup>nd</sup> layers of the sole to lateral 1½ toes.

**Deep divisions:** curves medially between 3<sup>rd</sup> & 4<sup>th</sup> layers.

- **Branches:** It corresponds to ulnar N. in the hand, supplies:
  - **Muscular to:**
    - Abductor digiti minimi.
    - Flexor accessorius, 2<sup>nd</sup>, 3<sup>rd</sup> & 4<sup>th</sup> lumbricals.
    - Adductor hallucis & flexor digiti minimi brevis.
    - Interossei.
  - **Cutaneous:** 1. Lateral  $\frac{1}{3}$  of the sole. 2. Lateral 1½ toes.

## D. Plantar arteries

They arise as the 2 terminal branches of the posterior tibial A

### 1. Medial plantar artery:

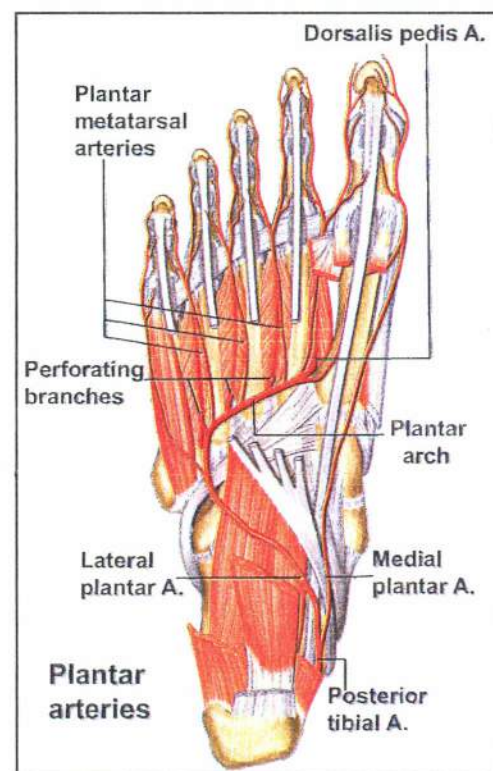
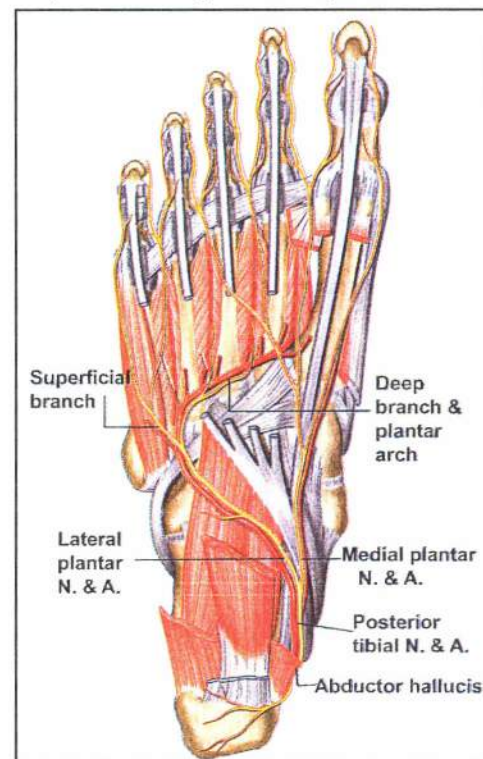
- It is the smaller of the 2 plantar arteries. It runs medial to the medial plantar nerve.
- It lies deep to the abductor hallucis. It supplies the medial side of big toe.

### 2. Lateral plantar artery:

- The larger terminal branch of posterior tibial artery.
- It passes forwards and laterally (between 1<sup>st</sup> & 2<sup>nd</sup> layers of the sole) to base of 5<sup>th</sup> metatarsal.
- It then turns medially (between 3<sup>rd</sup> & 4<sup>th</sup> layers of the sole) as the plantar arch.
- It ends at interval between of 1<sup>st</sup> and 2<sup>nd</sup> metatarsals anastomosing with dorsalis pedis artery.

#### Branches:

- Plantar digital artery for lateral side of little toe.
- 3 plantar metatarsal arteries, each artery divides into 2 plantar digital branches to supply the clefts between the lateral 4 toes.
- 3 perforating branches: They join the dorsal metatarsal arteries.





## Mechanism of walking

Walking is performed through successive steps. Each step is composed of stance & swing phases:

### A) Stance phase (when the limb is on the ground):

**It starts** by contact of the heel with the ground (heel strike). This is accompanied by extension of both hip & knee joints by hamstrings & quadriceps femoris muscles.

**The weight of the body** is transmitted forwards from the heel to lateral arch of the foot to the heads of the metatarsal bones (especially the 1<sup>st</sup> one).

**The soleus & gastrocnemius** contract to elevate the heel & toes from ground (heel off & toe off).

Gluteus medius & minimus of the supporting LL contract to prevent the pelvic tilt.

### B) Swing phase (when the limb is off the ground):

**At the time of the toe off**, the hip and knee joints are flexed and the ankle is dorsiflexed. These actions help to raise the foot more from the ground.

**This is followed by propelling of the leg** forwards through extension of the knee.

**The swing phase ends** by contact of the heel with the ground (heel strike) to complete the step.

## Transmission of the body weight

The body weight is transmitted from the vertebral column to the sacrum.

Then 50% of the body weight is transmitted to each sacroiliac joint.

### In standing position:

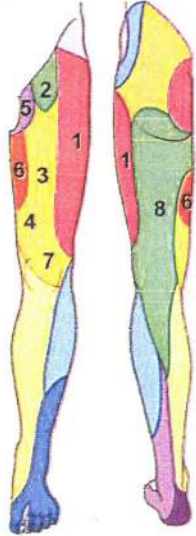
- The body weight on each side is transmitted from sacroiliac joint to hip joint then to the femur.
- The weight is transmitted to the lateral femoral condyle then to the tibia (fibula has no role).
- The weight is transmitted to the talus, 25% is transmitted to the calcaneus & 25% is transmitted forwards to the metatarsal bones (especially the 1<sup>st</sup> metatarsal bone as it is the thickest one).

**In sitting position:** 50% of body weight is transmitted from sacroiliac joint to ischial tuberosity.

## Cutaneous innervation of lower limb

### A- Cutaneous Nerves in Thigh

A- In front & sides "from lateral to medial":

	Nerve	Origin	Supplies	
1	Lateral cutaneous N. of thigh.	Lumbar plexus.	Lateral side of thigh.	
2	Femoral branch of genitofemoral N.	Lumbar plexus.	Skin of upper part of front of thigh (laterally).	
3	Ant. cutaneous N. of thigh.	Ant. division of femoral N.	Front of thigh.	
4	Medial cutaneous N. of thigh.	Ant. division of femoral N.	Medial part of thigh.	
5	Ilioinguinal N.	Lumbar plexus.	Upper part of front of thigh, near external genitalia.	
6	Cutaneous br. of obturator N.	Ant. division of obturator N.	Skin above medial side of the knee.	
7	Infrapatellar branch of saphenous N.	Saphenous N.	Shares in subsartorial & patellar plexuses.	

B- On Back: Posterior cutaneous N. of thigh (8): from sacral plexus to back of thigh.

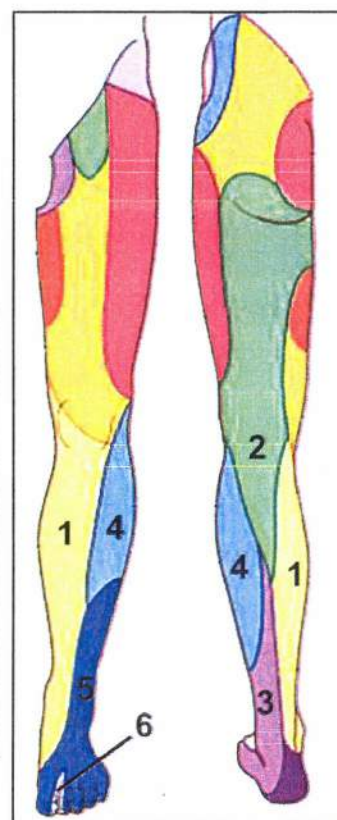
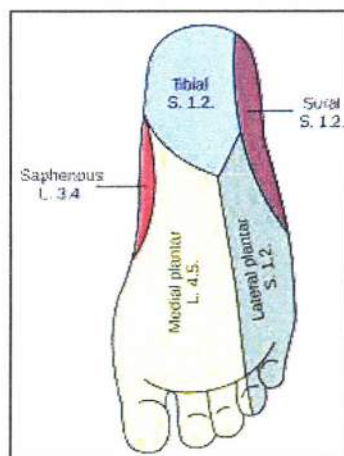


**B) The leg**

- 1- **Medial side of leg:** Saphenous nerve **1** (femoral).
- 2- **Back of leg:** - **Upper 1/3:** Posterior cutaneous nerve of thigh **2**.  
- **Lower 2/3:** Sural **3** (tibial nerve).
- 3- **Anterolateral aspect of leg:**
  - **Upper 2/3:** Lateral cutaneous nerve of calf **4** (common peroneal).
  - **Lower 1/3:** Superficial peroneal nerve **5**.

**C) The foot**

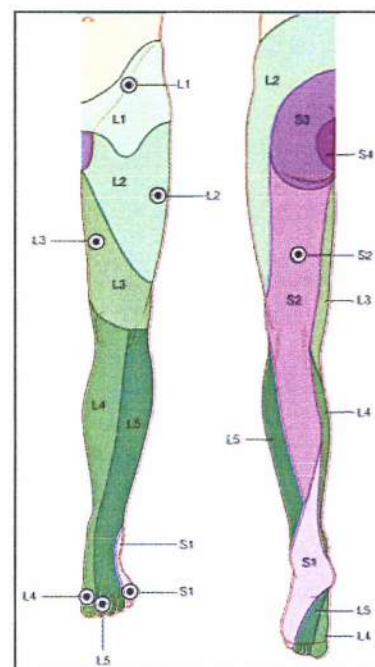
- **Dorsum of the foot:**
  - **Cleft between 1<sup>st</sup>, 2<sup>nd</sup> toes:** Deep peroneal N. **6**
  - **Medial border of the foot:** Saphenous N. **1**
  - **Lateral border of the foot:** Sural N. **3**
  - **Rest of the dorsum of the foot:** Superficial peroneal N. **5**
- **Sole of the foot:**
  - **Skin of the heel:** Posterior tibial N.
  - **Medial 2/3 of the sole & medial 3 1/2 toes:** Medial plantar N.
  - **Lateral 1/3 of the sole & lateral 1 1/2 toes:** Lateral plantar N.

**Segmental innervations of lower limb****Front of lower limb & dorsum of the foot:**

- L1: To front, medial and lateral aspects of thigh (below the inguinal ligament).
- L2: To front, medial & lateral aspects of thigh (in its middle area).
- L3: To front, medial and lateral aspects of thigh (above the knee).
- L4: To skin of medial side of front of leg, foot and dorsum of the big toe.
- L5: To skin of lateral side of front of leg, foot and dorsum of the 2<sup>nd</sup> to 4<sup>th</sup> toes.
- S1: Lateral aspect of leg, foot and dorsum of the little toe.

**Back of lower limb & sole of the foot:**

- L4, 5 & S1: To sole of the foot from medial to lateral
- S2: To back of leg and thigh till gluteal region.
- S3: To major area of the gluteal region.
- S4: To skin around anus.

**Superficial inguinal lymph nodes**

- 1) Vertical group: Along termination of long saphenous vein. It drains almost the whole of superficial tissues of lower limb.
  - 2) Medial group: Medial to saphenous opening. It drains A.A.W. below umbilicus & perineum.
  - 3) Lateral group: Lateral to saphenous opening. It drains the gluteal region.
- All superficial groups drain mainly to deep inguinal lymph nodes.

**Clinically important points:**

- Obstruction of the lymphatics of the lower limb → progressive oedema. When the limb acquires a large size, this condition is called elephantiasis.
- Lymphangitis is inflammation of the superficial inguinal lymph vessels.



## Hip joint

**Type:** Synovial, polyaxial, ball and socket.

**Ligaments:** Strengthen the capsule from outside.

### 1. Iliofemoral ligament:

- It is the strongest ligament in the body. It is Y-shaped:
- Stem: Is attached to anterior inferior iliac spine.
- Diverging bands: Are attached to intertrochanteric line.
- Function: 1- It reinforces the anterior aspect of the capsule.  
2- It limits overextension of the joint.  
3- It helps in transmission of the body weight.

### 2. Pubofemoral ligament:

- It connects iliopubic eminence to anteroinferior parts of the capsule.
- Function: 1- It reinforces the inferomedial part of the capsule. 2- It limits overabduction of the joint.

### 3. ischiofemoral ligament: It is weak ligament.

- It connects the ischial tuberosity to the posterosuperior part of the capsule.
- Function: 1- It reinforces back of the capsule. 2- It limits excessive medial rotation of the joint.

### 4. Labrum acetabulare: Is attached to margins of acetabulum increasing its depth.

### 5. Round ligament of head of femur:

- It is weak, triangular in shape. It is intracapsular extrasynovial.
- It carries blood to head of the femur.

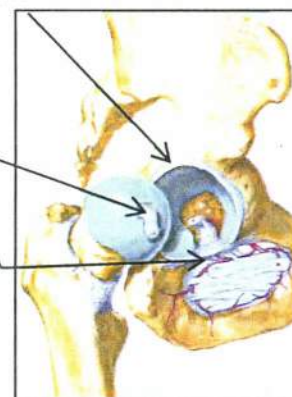
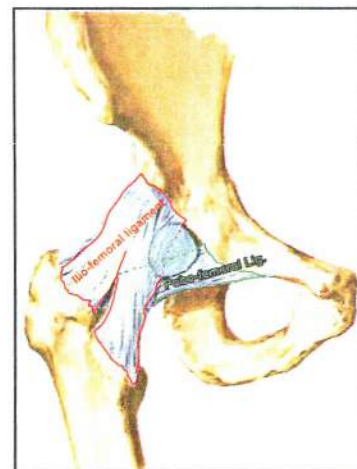
### 6. Transverse acetabular ligament: is attached to ends of acetabular notch.

**Stability of the joint:** It is so stable due to many factors:

- Bony factor: The head fits in the larger acetabulum.
- Ligamentous factors: Strong ligaments surround the joint.
- Muscular factors: the joint is surrounded by strong muscles.

**Movements of hip joint:** The wide range of mobility is due to:

- 1- The length of the neck of femur & its angle. 2- Narrow neck of femur compared to the head.



Movements	Muscles responsible
1. Flexion.	The main muscle: Iliopsoas. It is helped by: 1- Pectineus. 2- Sartorius. 3- Reflected head of rectus femoris. It is accompanied by passive medial rotation.
2. Extension.	<b>Gluteus maximus:</b> During running, climbing upstairs. <b>Hamstrings:</b> On walking on a level
3. abduction	The main muscles: Gluteus medius & minimus. It is helped by: 1- Tensor fasciae latae. 2- Sartorius.
4. Adduction	The main muscles: 3 adductors. It is helped by: Pectineus & gracilis.
5. Med. rotation	- Anterior fibers of gluteus medius & minimus. - Tensor fasciae latae. - Adductors.
6. Lat. rotation	- Gluteus maximus. - 6 lateral rotators. - Sartorius.



## Knee joint

**Type:** It is synovial joint of condyloid (modified hinge), as it allows rotation on flexion.

**Bones forming the joint:** Lower end of femur, upper end of tibia & back of patella.

### Bursae around the knee:

#### A. Anteriorly:

1. Prepatellar (housemaid's) bursa: It is inflamed, swells with frequent kneeling (housemaid's knee).
2. Superficial infrapatellar bursa: In front of tibial tuberosity.
3. Deep infrapatellar bursa, deep to ligamentum patellae.
4. Suprapatellar bursa between femur & quadriceps femoris tendon.

#### B. Posteromedially:

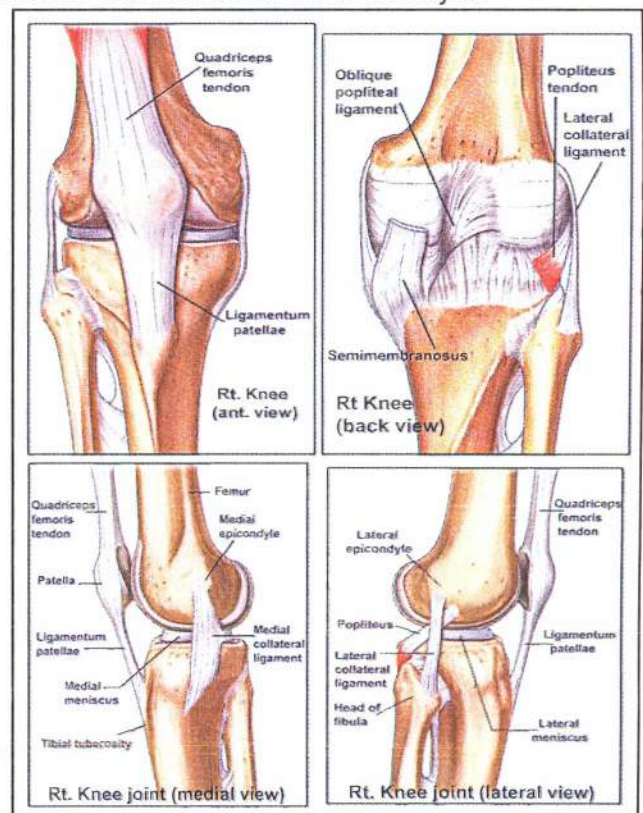
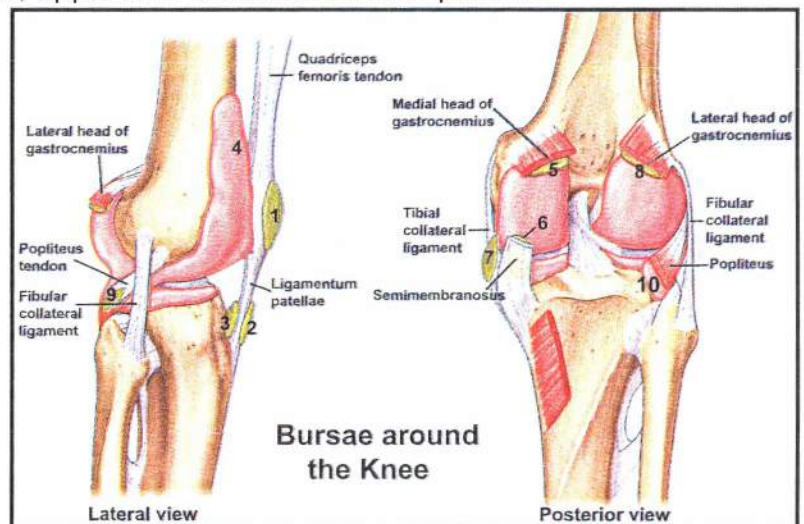
5. Deep to medial head of gastrocnemius between it and the capsule.
6. Deep to semimembranosus (semimembranosus bursa) between it and medial tibial condyle.
7. A bursa between SGS & medial ligament of knee.

#### C. Posterolaterally:

8. A bursa deep to lateral head of gastrocnemius.
9. A bursa between biceps & fibular collateral ligament.
10. A bursa deep to popliteus tendon.

### Ligaments: A. Extra capsular ligaments (4)

1. Patellar ligament:
  - It connects apex of patella to tibial tuberosity.
  - It is continuation of quadriceps femoris tendon.
2. Fibular (lateral collateral) ligament:
  - It is cord-like, connects lateral epicondyle of femur to head of fibula.
  - Popliteus tendon separates it from lateral meniscus.
3. Tibial collateral (medial collateral) ligament:
  - It is triangular, extends from med. epicondyle of the femur to medial condyle of tibia.
  - It is firmly attached to the medial meniscus.
  - A bursa lies between it and tendons of SGS.
  - It is frequently torn with medial meniscus in football players.
4. Oblique popliteal ligament:
  - It an expansion of semimembranosus.
  - It passes upwards and laterally.





## B. Intracapsular ligaments (6)

	1- Medial meniscus	2- Lateral meniscus
<b>Shape</b>	C- Shaped "small piece of large circle". Larger. Its outer border is thick & its inner border is thin.	O- Shaped "large piece of small circle". Smaller. Its outer border is thick & its inner border is thin.
<b>Attachments</b>	Its <u>anterior horn</u> is attached to the most anterior part of the intercondylar area while its <u>posterior horn</u> is attached just in front of the posterior cruciate ligament.	Both horns are attached to just in front and behind the intercondylar eminence of the tibia.
<b>Mobility</b>	It is more fixed as it adheres to the deep surface of the tibial collateral ligament.	It is more freely movable as popliteus tendon separates it from fibular collateral ligament.
<b>Functions of menisci</b>	- They deepen the articular surface of the upper end of the tibia. - They act as shock absorbers.	
<b>Injury</b>	The medial meniscus is more liable to be injured as: 1- It is more fixed.      2- The medial condyle is concerned with rotation. 3- During rotation of the flexed joint it becomes tight.	

3. **Coronary ligaments:** Capsular fibers that attach margins of the menisci to the tibial condyles.

4. **Transverse ligament of the knee:** joins anterior horns of both menisci (no bony attachments).

	5- Anterior cruciate ligament	6- Posterior cruciate ligament
<b>Attachment to tibia</b>	Ant. intercondylar area, between anterior horns of the 2 menisci.	Post. intercondylar area, behind posterior horn of the medial meniscus.
<b>Direction</b>	Upwards, backwards & laterally.	Upwards, forwards & medially.
<b>Attachment to femur</b>	Posterior part of inner surface of lateral condyle of the femur.	Anterior part of inner surface of medial condyle of the femur.
<b>It is tense in</b>	Extension.	Flexion.
<b>Function</b>	It prevents: 1- Hyperextension. 2- Posterior dislocation of femur. 3- Anterior dislocation of the tibia.	It prevents: 1- Anterior dislocation of femur. 2- Posterior dislocation of the tibia.
<b>Strength</b>	It is weaker, has less blood supply.	It is stronger.

## N.B.: Intracapsular structures of knee joint are:

1. Medial meniscus.
2. Lateral meniscus.
3. Transverse ligament of knee.
- 4&5. Anterior & posterior cruciate ligaments.
6. Tendon of popliteus.
7. Infrapatellar pad of fat.
8. Infrapatellar fold of synovial membrane.
9. Coronary ligaments.

## Movements:

Movements	Muscles responsible
1. Flexion	- Hamstrings (main muscles), helped by sartorius, gracilis & popliteus.
2. Extension	- Quadriceps femoris (main muscle), helped by tensor fasciae latae.
3. Medial rotation	- Popliteus. – Semimembranosus & SGS help popliteus in unlocking.
4. Lateral rotation	- Biceps femoris.



**Locking & unlocking of the knee:**

	Locking	Unlocking
<b>Mechanism</b>	Lateral rotation of the tibia on femur or medial rotation of femur on tibia (when the tibia is fixed).	Medial rotation of the tibia on femur or lateral rotation of femur on tibia (when the tibia is fixed).
<b>Occurs</b>	After full extension to make the lower limb as a rigid column.	At the beginning of flexion.
<b>Ligaments become tense</b>	- Anterior cruciate ligament. - Tibial & fibular collateral ligaments. - Posterior oblique ligament.	- Posterior cruciate ligament.
<b>Muscles involved</b>		- Popliteus. – SGS.

**Tibio - fibular joints**

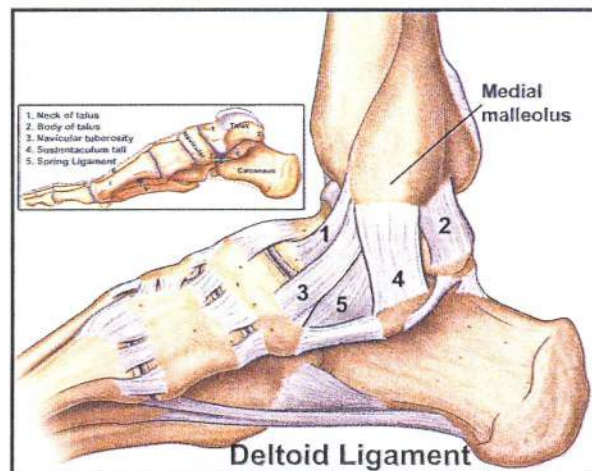
1. **Superior tibiofibular joint:** It is synovial, plane joint.
2. **Interosseous membrane:** it directs downwards and laterally.
3. **Inferior tibiofibular joint:** It is fibrous joint (syndesmosis).

**Ankle joint**

**Type:** Uni-axial hinge synovial joint.

**Ligaments:****1. Medial collateral (deltoid) ligament:**

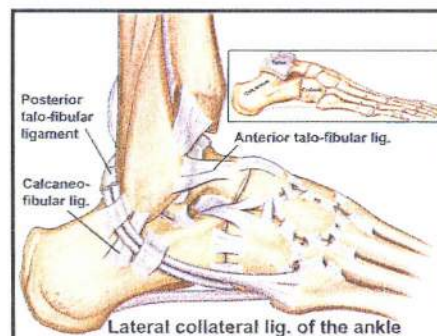
- It is a strong triangular band.
- Its apex is attached to the medial malleolus.
- Its base is attached to:
  - 1- Neck of talus.
  - 2- Body of talus.
  - 3- Navicular tuberosity.
  - 4- Sustentaculum tali.
  - 5- Spring ligament.

**2. Lateral collateral ligament: (3 bands):**

- a. **Anterior talofibular ligament:** Extends between anterior margin of lateral malleolus & talus.
- b. **Posterior talofibular ligament:** between malleolar fossa & talus.
- c. **Calcaneofibular ligament:** Extends between the lateral malleolus to lateral surface of calcaneus.

**3. Posterior tibiofibular ligament:**

It extends between malleolar fossa to medial malleolus of tibia.

**Movements:**

Movement	Muscles responsible
<b>Dorsiflexion (extension).</b>	Muscles of front of leg (TA, EHL, EDL & PT).
<b>Plantar flexion (flexion).</b>	-Tendocalcaneus (soleus & gastrocnemius). – Peroneus longus & brevis. - Deep calf muscles (TP, FDL & FHL).

**Joints of the Foot****1- Talocalcanean (subtalar) joint**

- **Type:** Synovial joint of plane variety.



## 2- Talocalcaneo-navicular joint

- **Type:** Synovial, complex ball and socket

- **Ligaments:**

### 1. Spring (plantar calcaneonavicular) ligament:

- It extends between plantar surface of sustentaculum tali & navicular tuberosity.
- Functions: 1- Maintenance of med. longitudinal arch. 2- Supports head of talus (on standing).
- Its medial margin gives attachment to the deltoid ligament.
- Its inferior surface is supported by the tibialis posterior tendon.

### 2. Calcaneonavicular ligament (medial limb of bifurcate ligament):

The stem of the bifurcate ligament is attached to upper surface of calcaneus.

It has two limbs: calcaneocuboid (lateral limb, corresponds to the short plantar lig.) and calcaneonavicular (medial limb, corresponds to the spring lig.).

### 3. Talonavicular ligament:

It connects the neck of the talus to the navicular bone & supports the capsule superiorly.

- **Movements of talo calcaneo navicular and subtalar joints:**

Inversion & eversion occur around an antero-posterior axis (passes through the head and neck of talus). It extends upwards, forwards and medially.

The calcaneus & navicular bones move around the talus which is fixed between the 2 malleoli.

	Movement	Muscles responsible
1- Inversion (more range).	The foot rotates medially & sole faces inwards.	1. Tibialis posterior. 2. Tibialis anterior.
2- Eversion (less range).	The foot rotates laterally & sole faces outwards.	The 3 Peronei

## 3- Calcaneocuboid joint

- **Type:** Synovial joint of plane variety.

- **Ligaments:**

1- Dorsal calcaneocuboid ligament.

2- Bifurcate ligament.

3. Long plantar ligament: Connects calcaneus, cuboid to bases of 2<sup>nd</sup>, 3<sup>rd</sup> & 4<sup>th</sup> metatarsal bones.

4. Short plantar ligament: Extends between calcaneus & plantar surface of cuboid bone.

***Good Luck***